Model V-85 (MC and SC)

Atom Infant Incubator

Service Manual

Printed in Jan. 1995

-V03.700-

ATOM MEDICAL CORPORATION

3-18-15, Hongo, Bunkyo-ku, Tokyo, Japan.

Introduction

The ATOM Model V-85 INFANT INCUBATOR controls via microprocessor the incubator air temperature to provide an optimum, hitherto unavailable physiological environment for an infant in the incubator. It is equipped with various alarms designed for patient safety. Please make certain that the incubator has been operated properly before coming to the conclusion that the incubator is out of order. In many cases, lack of knowledge of the operating procedures is the cause of mistaking an activated alarm for a malfunction.

Table of Contents

1. Specifications of V-85 Infant Incubator 4

2. Composition of V-85 Infant Incubator 6

3. Block Diagram 9

4. Wiring Diagram 10

5. 8302A (CPU Board) Circuit Diagram 13

8302B (Switch Board) Circuit Diagram

8302G (Heater Board) Circuit Diagram

8302D (Skin Temperature Probe Board) Circuit Diagram

8302E (Sensor Block Board) Circuit Diagram

6. Description of Circuitry and Function Test I 19

6-1 Reference voltage circuit

6-2 Over-temperature detection circuit

6-3 A/D converter circuit

6-4 Key input circuit

6-5 Display unit

6-6 Power failure detection/battery charge circuit

6-7 Heater output/heater current detection circuit

6-8 CPU runaway detection circuit

6-9 Data backup with EEPROM

6-10 DC+5V, ±12V regulator

7. Function Test 2 (Internal Test with Display) 25

7-1 Display test

7-2 Sensor test

8. Function Test 3 (Special Internal Test with Keyboard)..27
8-1 Test Mode 1 (AD/Internal circulation/Others)
8-2 Test mode 2 (Over-temperature)
9. Function Test 4 (Test with Simulator) 34
9-1 Sensor open test
9-2 Sensor short test
9-3 36.0°C test
9-4 Simulation test
10. Initialization of Internal Air Circulation.....36
10-1 Initialization
11. Over-temperature Adjustment.....39
12. List of Alarms.....41
13, Troubleshooting.....45
13-1 When power switch is turned on
13-2 Immediately after self-diagnosis test
13-3 Over-temperature alarm
13-4 Internal air circulation alarm
13-5 Incubator sensor alarm
13-6 Others
14. Reporting of Trouble 53

1. Specifications of V-85 Infant Incubator

Electrical requirements: Customer-specified

Skin temperature/incubator temperature control mode: SC/MC system

Skin temperature setting: 34.0-38.0°C in 0.1°C steps

Skin temperature indication: 30.0-42.0°C in 0.1°C steps

Incubator temperature setting: 25.0-38.0°C in 0.1°C steps

Incubator temperature indication: 20.0-42.0°C in 0.1°C steps

Humidity indication: Switch-selected

Humidity: 20-99% in 1% steps

Heater output: 0-Full, indicated in 12 degrees

Alarms:

Over-temperature alarm

Should the displayed value of the incubator air temperature exceed 39.0°C or should the temperature of the over-temperature sensor exceed 39.5±0.5°C, the over-temperature indicator lamp will flash, an audible alarm will sound, and the heater power will be disconnected.

Internal air circulation alarm

Should any trouble develop within the air circulation system, the appropriate indicator lamp will falsh, an audible alarm will sound, and the heater power will be disconnected.

High/low temperature alarm

(MC mode of operation) Should the incubator air temperature exceed the pre-selected temperature by more than 1.5°C or drop below the set temperature by more than 3°C, the selected temperature indicator lamp will flash and an audible alarm will sound.

(SC mode of operation) Should the infant's skin temperature deviate from the pre-selected temperature by more than ±1°C, the selected temperature indicator lamp will flash and an audible alarm will sound.

Internal sensor alarm

Should any trouble develop on any of the sensors for incubator air temperature, humidity, over-temperature and internal air circulation, the internal sensor indicator lamp will flash and an audible alarm will sound.

Skin temperature probe alarm

Should any trouble develop on the skin temperature probe, the skin temperature probe indicator lamp will flash, an audible alarm will sound and the heater power will be disconnected.

Power failure alarm

Should power supply be interrupted due to power failure or other causes, the power failure indicator lamp will be illuminated and an audible alarm will sound.

2. Composition of V-85 Infant Incubator (temperature control)

V-85 Infant Incubator is composed of six sensors to monitor several temperatures, humidity and air flow respectively, a heater to warm up the incubator air, a fan for internal air circulation and six P.C. boards for controlling and displaying such features or parameters.

2.1 Functions of sensors

Incubator air temperature sensor

Detects the air temperature in the incubator.

Relative humidity sensor

Detects the temperature affected by evaporation heat. The sensor is covered with a wet nonwoven fabric.

Over-temperature sensor

Detects an excessive rise in the incubator air temperature using an independent circuit.

Air flow sensor

Detects changes in the internal air circulation.

Skin temperature sensor

Detects the infant's skin temperature. The sensor is attached to the infant's skin.

2.2 Primary functions of boards

8302A The main board equipped with CPU, in charge of all controls.

8302B The switch board equipped both with switches for operation and with power failure alarm LED.

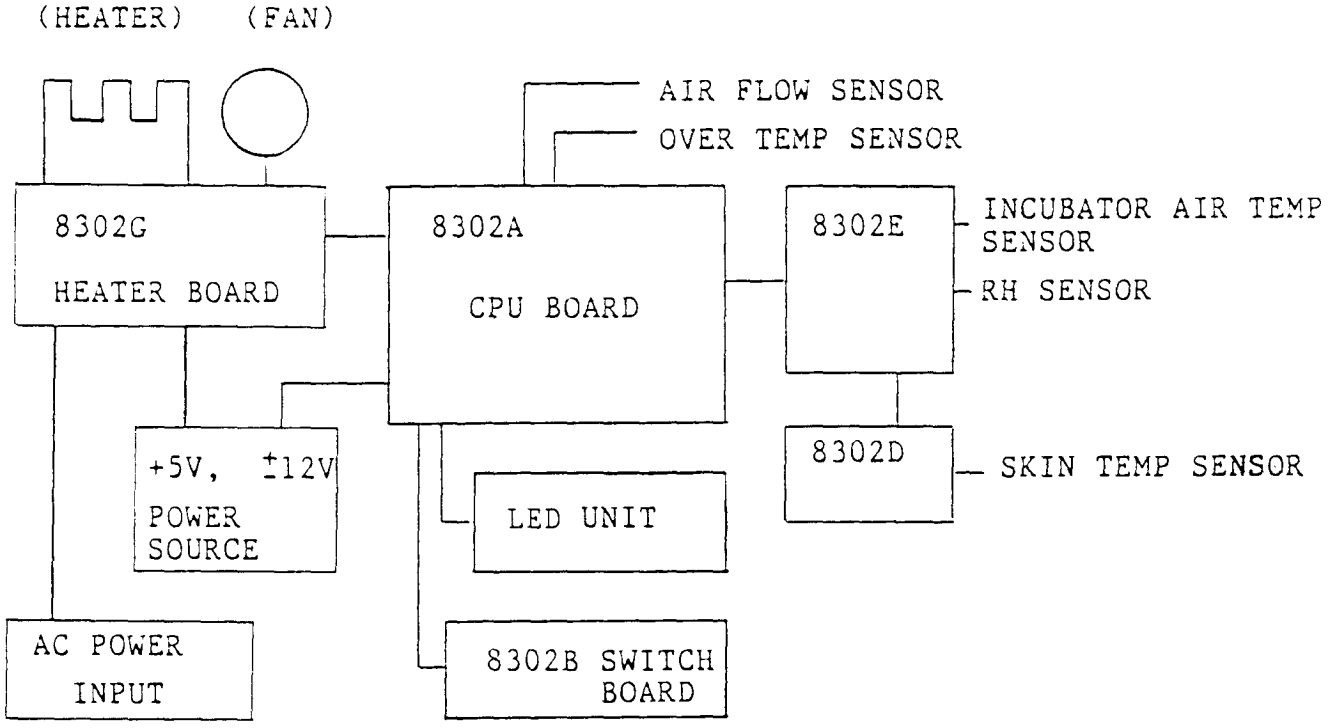
8302G Equipped with a heater power control relay and a current-detecting coil.

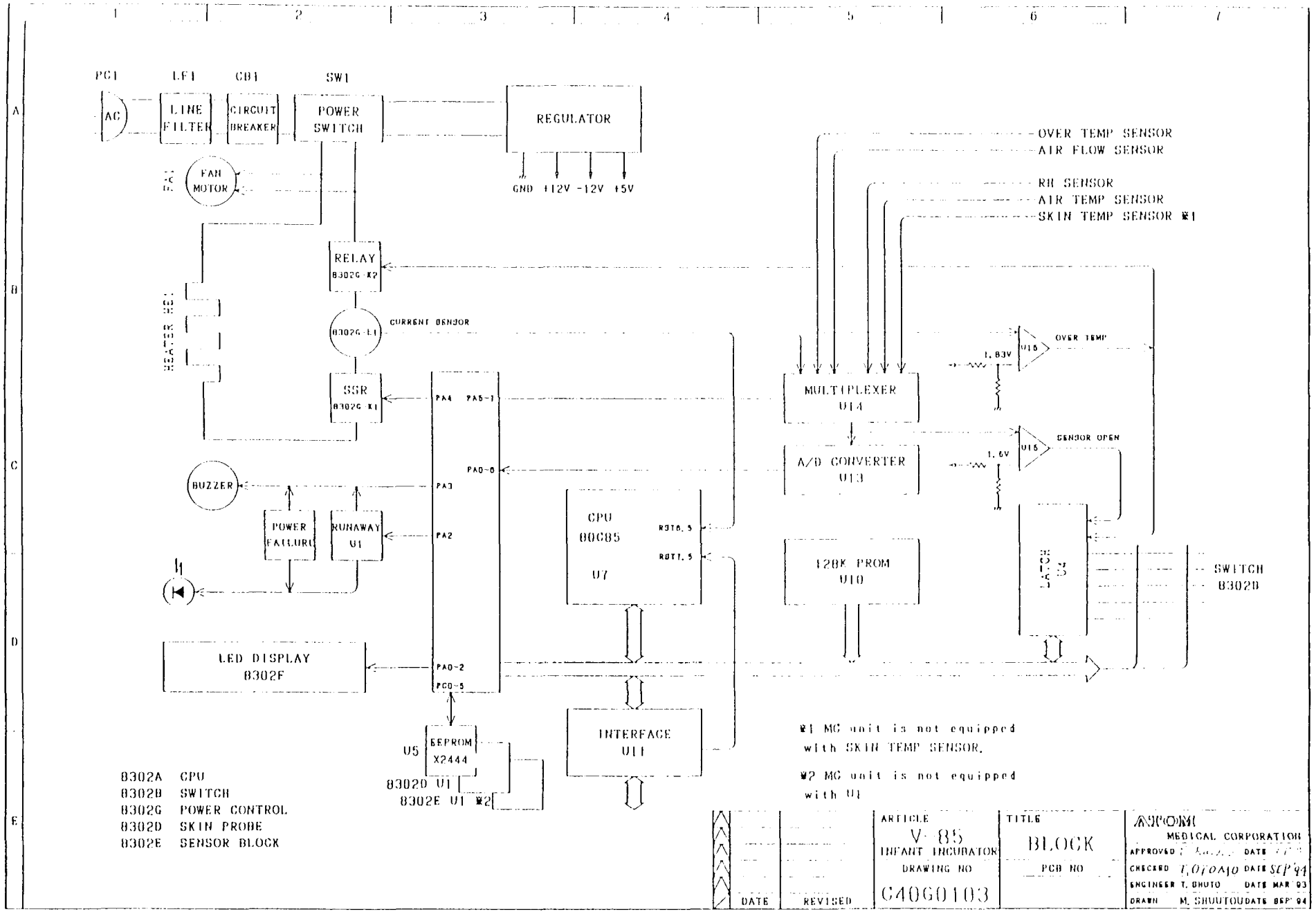
8302D Equipped with EEPROM in which data from a skin temperature thermistor are stored.

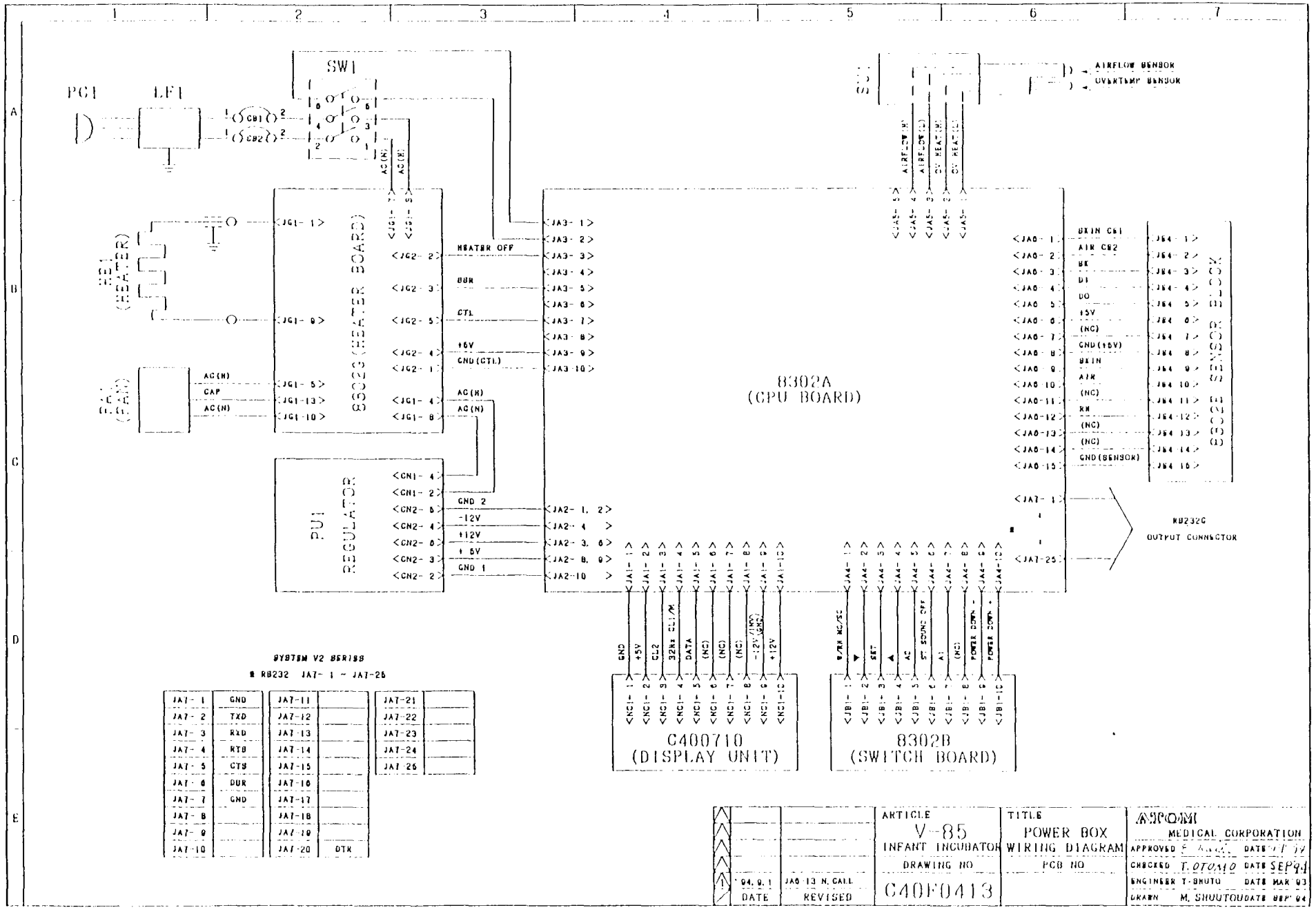
8302E Equipped both with thermistors for incubator air temperature, RH and with EEPROM in which sensor calibration values are stored.

2.3 Others

Power source	+5V (3A), +12V (1.2A), -12V (0.3A)
Heater	260VA
Fan motor	Makes the air circulate in V-85 Infant Incubator
LED unit	Displays various control data and conditions of V-85 Infant Incubator


(HEATER)
(FAN)
AIR FLOW SENSOR
OVER TEMP SENSOR
8302G
HEATER BOARD
8302A
CPU BOARD
8302E
INCUBATOR AIR TEMP SENSOR
RH SENSOR
+5V, ±12V
POWER SOURCE
LED UNIT
8302D
SKIN TEMP SENSOR
AC POWER INPUT
8302B SWITCH BOARD


PC1
LF1
CB1
SW1
AC
LINE FILTER
CIRCUIT BREAKER
POWER SWITCH
REGULATOR
GND +12V -12V +5V
FAN MOTOR
RELAY
8302G-K2
HEATER SET
8302G-T1
CURRENT SENSOR
SSR
8302G-K1
BUZZER
POWER FAILURE
RUNAWAY U1
LED DISPLAY
8302F
PA4
PA5-7
PA0-6
PA3
PA2
PA0-2
PC0-5
CPU
80C85
U7
R3T0.5
R0T7.5
U5
EEPROM
X2444
8302D U1
8302E U1 ※2
INTERFACE
U11
OVER TEMP SENSOR
AIR FLOW SENSOR
RH SENSOR
AIR TEMP SENSOR
SKIN TEMP SENSOR ※1
MULTIPLEXER
U14
A/D CONVERTER
U13
128K PROM
U10
1.83V
U16
OVER TEMP
1.6V
U15
SENSOR OPEN
LATCH
U2
SWITCH
8302D
8302A CPU
8302B SWITCH
8302G POWER CONTROL
8302D SKIN PROBE
8302E SENSOR BLOCK
※1 MC unit is not equipped with SKIN TEMP SENSOR.
※2 MC unit is not equipped with U1
DATE
REVISED
ARTICLE
V-85
INFANT INCUBATOR
DRAWING NO
C40G0103
TITLE
BLOCK
PCB NO
ATOM
MEDICAL CORPORATION
APPROVED
DATE
CHECKED T. OHOTO DATE SEP'94
ENGINEER T. OHUTO DATE MAR'93
DRAWN M. SHUUTOU DATE SEP'94

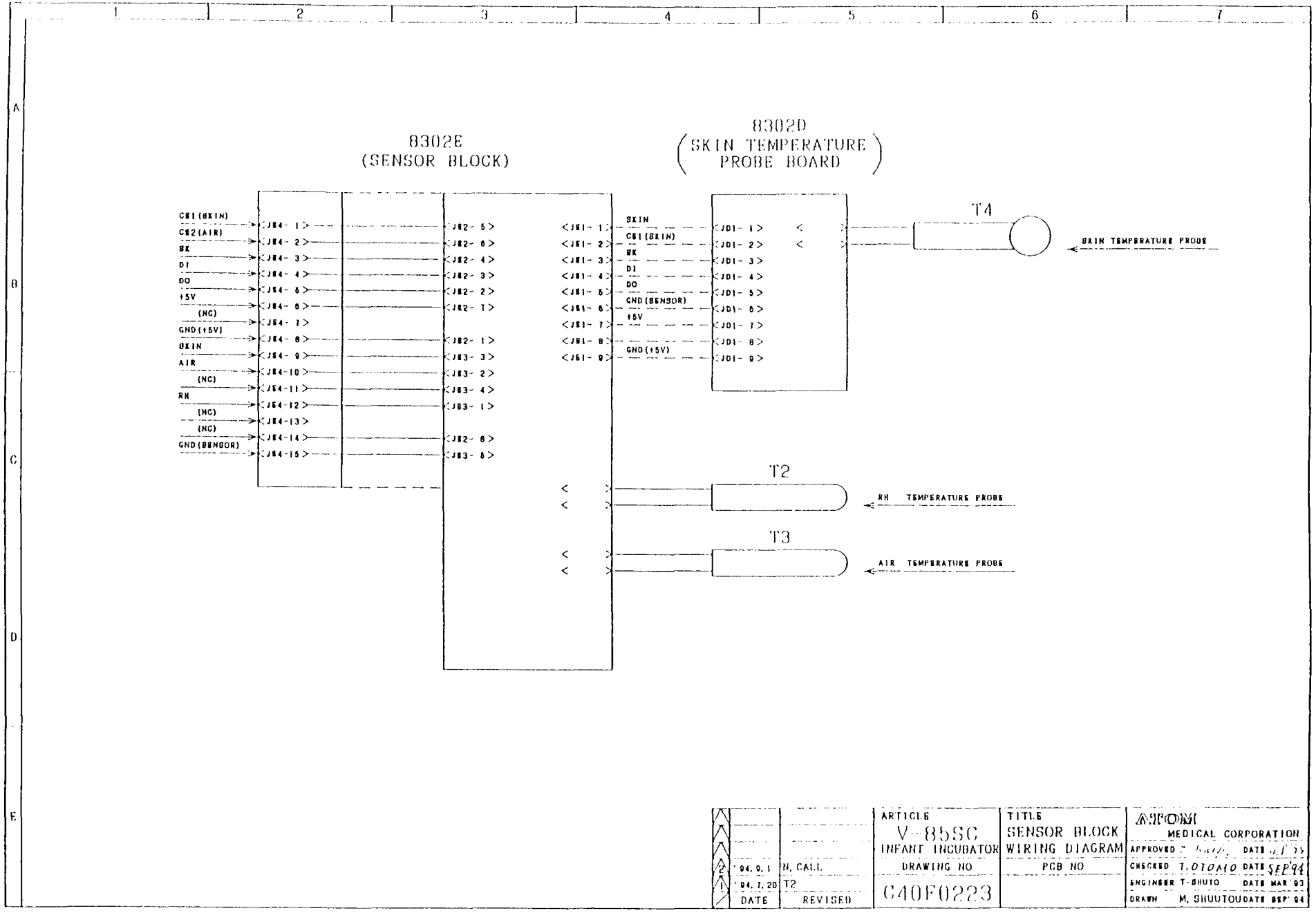


SYSTEM V2 SERIES

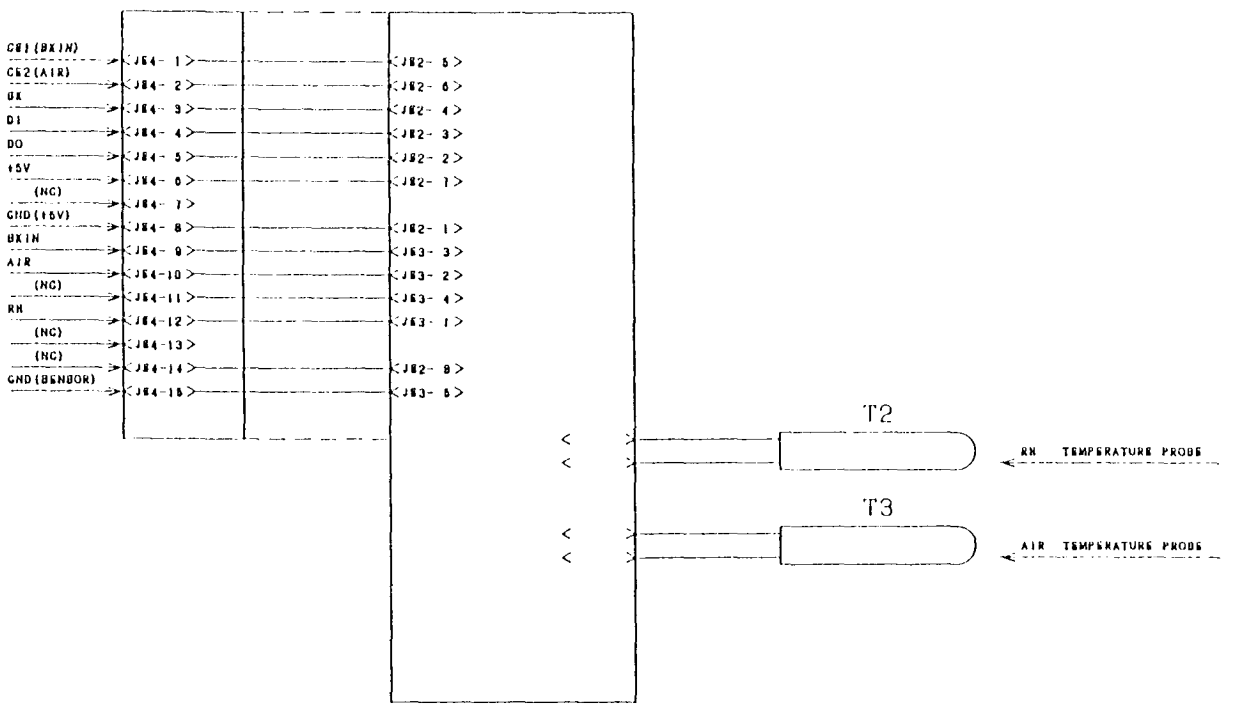
※ RS232 JA7- 1 ~ JA7-25

JA7- 1	GND	JA7-11		JA7-21	
JA7- 2	TXD	JA7-12		JA7-22	
JA7- 3	RXD	JA7-13		JA7-23	
JA7- 4	RTS	JA7-14		JA7-24	
JA7- 5	CTS	JA7-15		JA7-25	
JA7- 6	DSR	JA7-16			
JA7- 7	GND	JA7-17			
JA7- 8		JA7-18			
JA7- 9		JA7-19			
JA7-10		JA7-20	DTR		

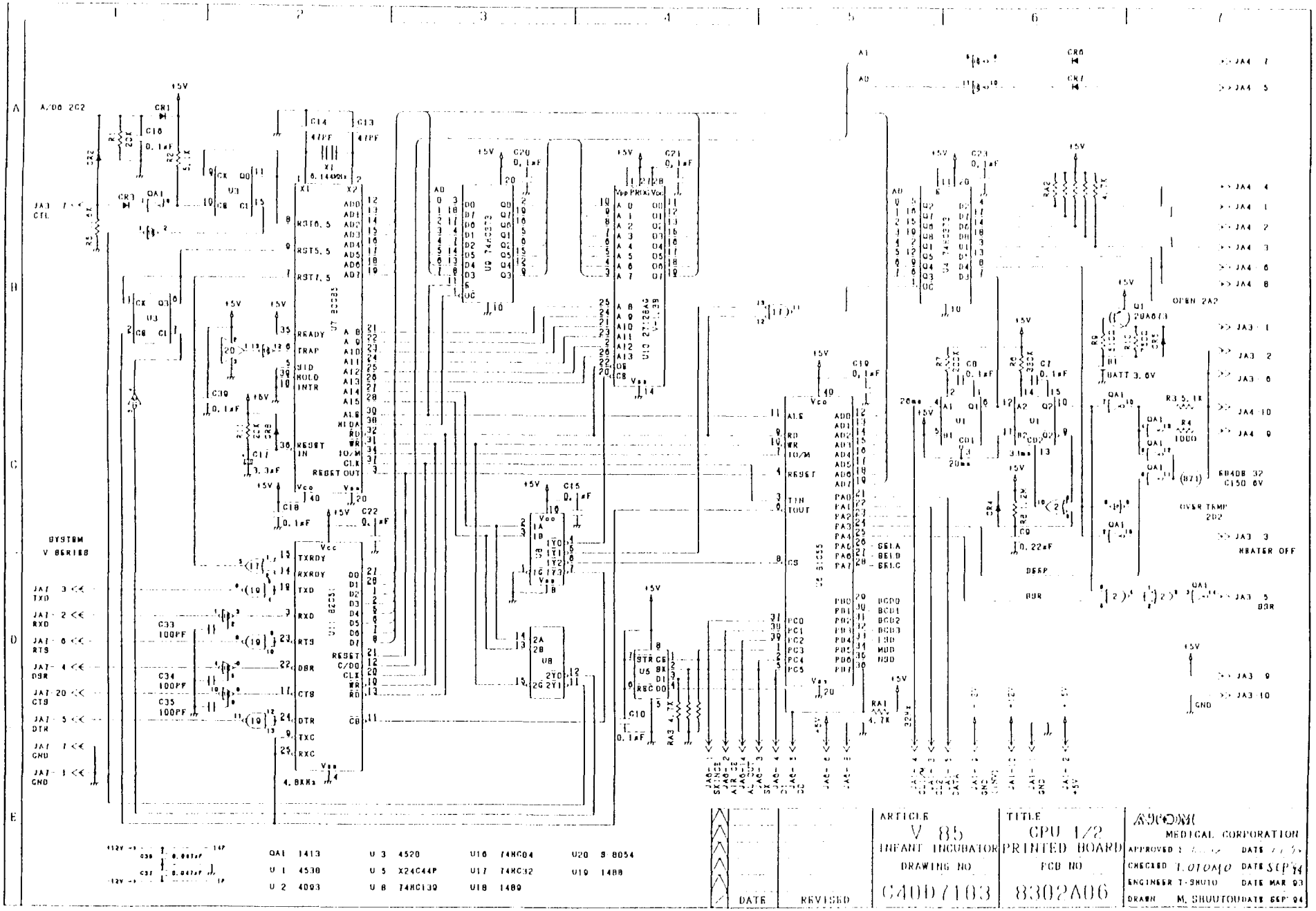
1	94. 9. 1 DATE	JA6-13 N. CALL REVISED	ARTICLE V-85 INFANT INCUBATOR	TITLE POWER BOX WIRING DIAGRAM	ATOM MEDICAL CORPORATION
			DRAWING NO C40E0413	PCB NO	APPROVED DATE
					CHECKED T.OTOMO DATE SEP.94
					ENGINEER T.SHUTO DATE MAR.93
					DRAWN M. SHUUTOU DATE SEP.94

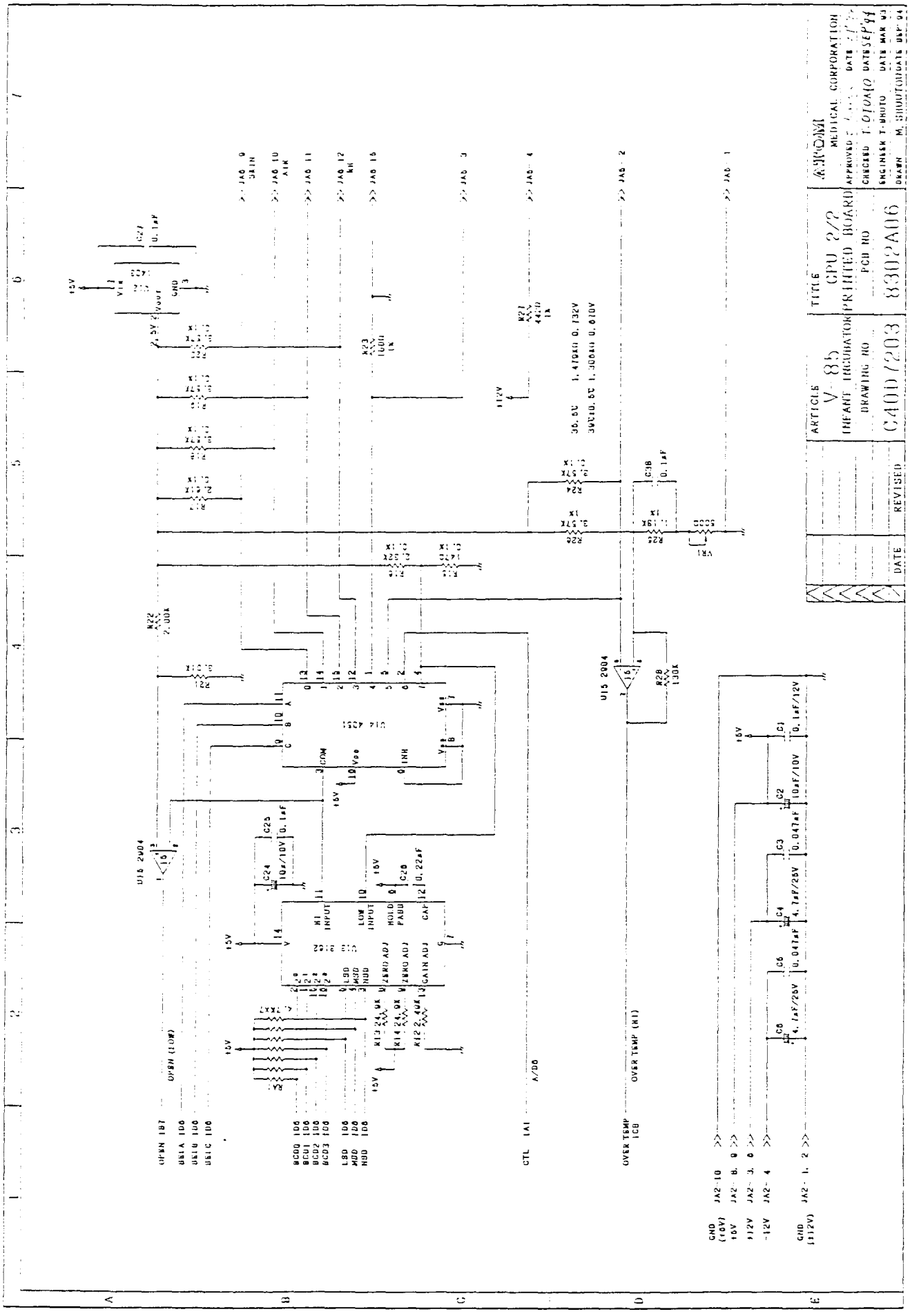


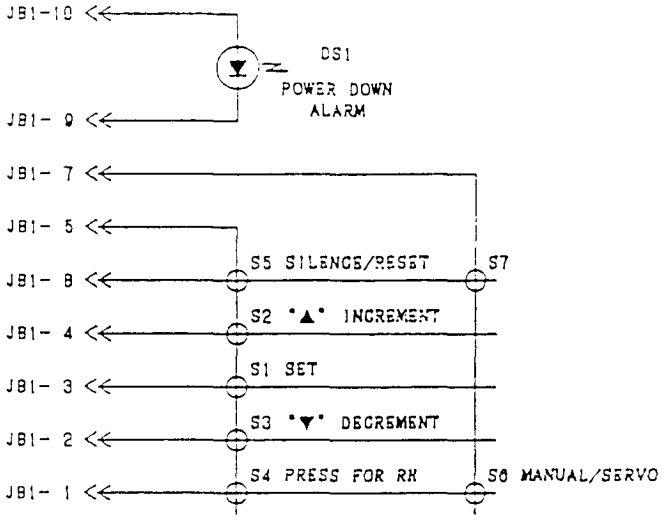
			ARTICLE V-855C INFANT INCUBATOR	TITLE SENSOR BLOCK WIRING DIAGRAM	ATOM MEDICAL CORPORATION
2	'94. 9. 1	N. CALL	DRAWING NO C40F0223	PCB NO	APPROVED DATE
1	'94. 7. 20	T2			CHECKED T. OTOMO DATE SEP'94
	DATE	REVISED			ENGINEER T. SHUTO DATE MAR'93
					DRAWN M. SHUUTOU DATE SEP'94



			ARTICLE V-85MC INFANT INCUBATOR	TITLE SENSOR BLOCK WIRING DIAGRAM	ATOM MEDICAL CORPORATION
			DRAWING NO	PCB NO	APPROVED DATE SEP '94
1	'94.9.1 DATE	N. CALL REVISED	C41F0203		CHECKED T.OTOMO DATE SEP'94
					ENGINEER T.SHUTO DATE MAR '93
					DRAWN M. SHUUTOU DATE SEP '94

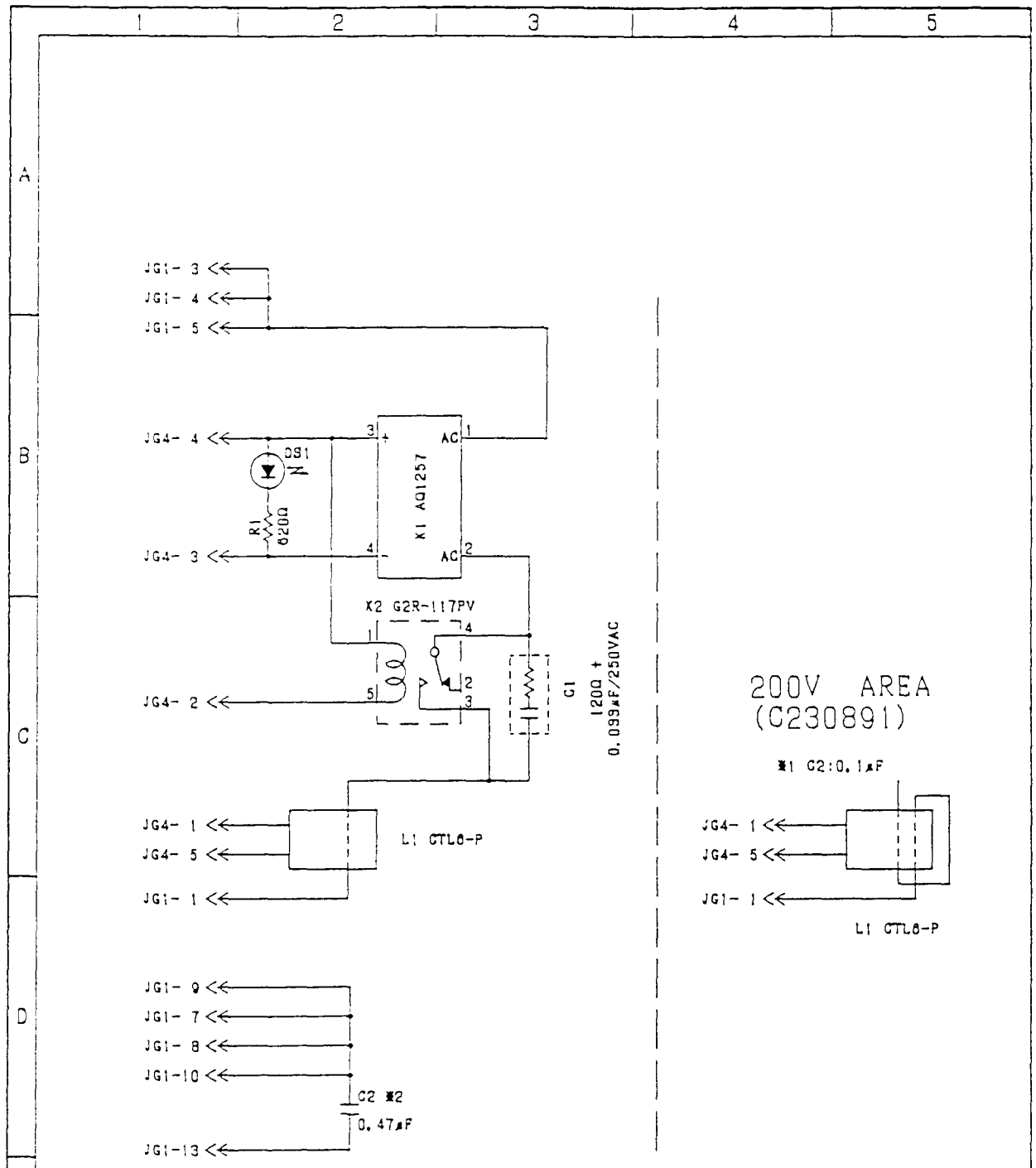

SYSTEM
V 85R188
U 1 4538
U 2 4093
U 3 4520
U 5 X24C44P
U 8 74HC139
U16 74HC04
U17 74HC32
U18 1489
U19 1488
U20 S 8054
ARTICLE
V 85
INFANT INCUBATOR
DRAWING NO
C40D/103
TITLE
CPU 1/2
PRINTED BOARD
PCB NO
83028A06
MEDICAL CORPORATION
DRAWN M. SHUUTOU
DATE SEP '94
REVISED
DATE


ARTICLE
V-85
INFANT INCUBATOR
DRAWING NO
G4010/2003
TITLE
CPU 2/2
PRINTED BOARD
PCB NO
83002A016
ATOM
MEDICAL CORPORATION
DATE
REVISED
DATE

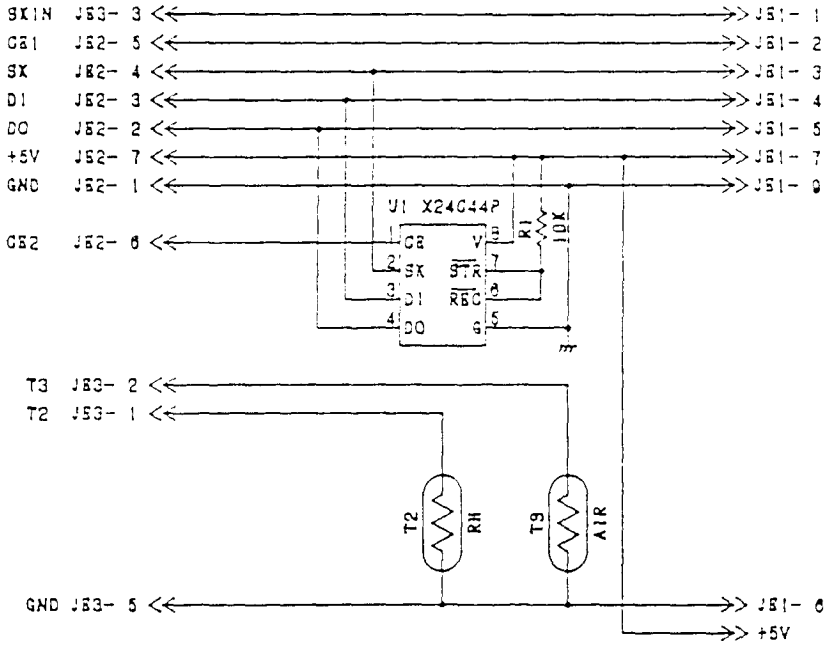


※ MC Unit is not equipped with S6.

		ARTICLE V-85 INFANT INCUBATOR	TITLE SWITCH PRINTED BOARD	ATOM MEDICAL CORPORATION
		DRAWING NO	PCB NO	CHECKED T. OTOMO DATE SEP'94
1	'94.7.20 S4 (SC only)	C40D7314	8302B03	ENGINEER T.SHUTO DATE MAR'93
	DATE REVISED			DRAWN M. SHUUTO DATE SEP'94

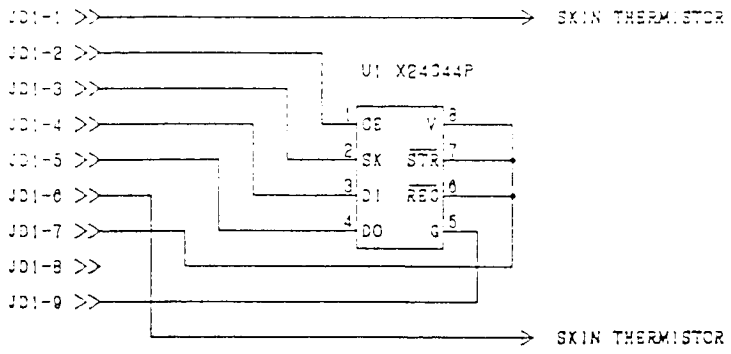


		ARTICLE V-85 INFANT INCUBATOR	TITLE HEATER PRINTED BOARD	ATOM MEDICAL CORPORATION
		DRAWING NO	PCB NO	APPROVED / DATE
				CHECKED / DATE
1	'94. 9. 1 PCB	C40D8814	C230881	ENGINEER T. KAWASAKI DATE MAR'87
	DATE REVISED			DRAWN M. SHUUTOU DATE SEP'94



※ MC Unit is not equipped with JB1

		ARTICLE V-85 INFANT INCUBATOR	TITLE SENSOR BLOCK PRINTED BOARD	ATOM MEDICAL CORPORATION
				APPROVED DATE
2	'94. 9. 1 R2, Q1	DRAWING NO	PCB NO	CHECKED T. OTOMO DATE SEP'94
1	'94. 7. 20 T2 (SC only)	C40D7624	8302E02	ENGINEER T. SHUTO DATE MAR'93
	DATE REVISED			DRAWN M. SHUUTOU DATE SEP'94



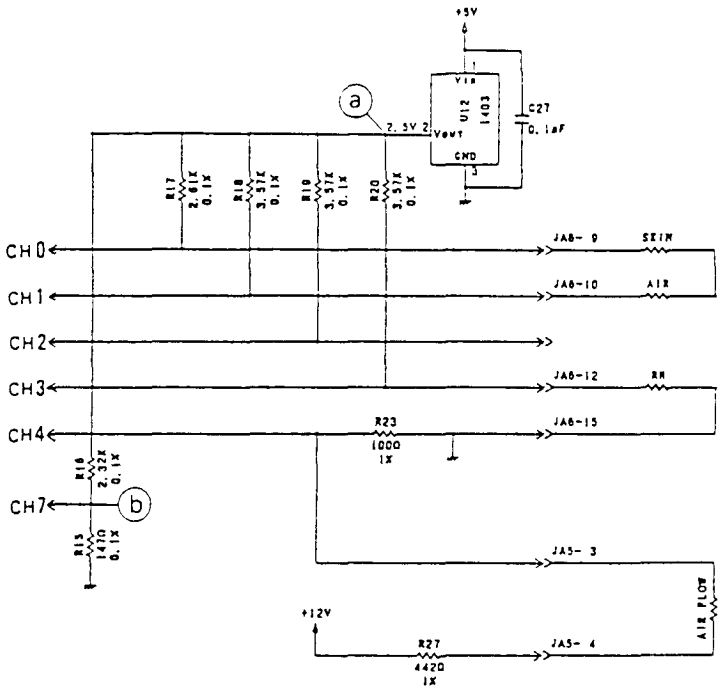
		ARTICLE	TITLE	ATOM MEDICAL CORPORATION
		V-85 INFANT INCUBATOR	SKIN PROBE PRINTED BOARD	APPROVED DATE SEP '94
		DRAWING NO	PCB NO	CHECKED T.OTOMO DATE SEP'94
		C40D8204	8302D00	ENGINEER T.SHUTO DATE MAR'93
DATE	REVISED			DRAWN M. SHUUTOU DATE SEP'94

6. Description of Circuitry

6-1 Reference voltage input

As the unit must measure temperature very accurately, 2.5V±25mV is supplied by an IC (U12, pin2) designed to generate highly precise reference voltage.

Output, in proportion to changes in temperature detected by each sensor, is generated at CH0-4.



(Test Point) * a ... 2.5V ± 25mV

* b ... 0.15V ± 5mV

* If virtual resistance (1K～2kΩ) is inserted in the sensor section, specified voltage divided by R17～20 or R23 and R27 is fed to CH0 - 4.

6-2 Over-temperature detection circuit

An over-temperature condition is detected by the following two methods:

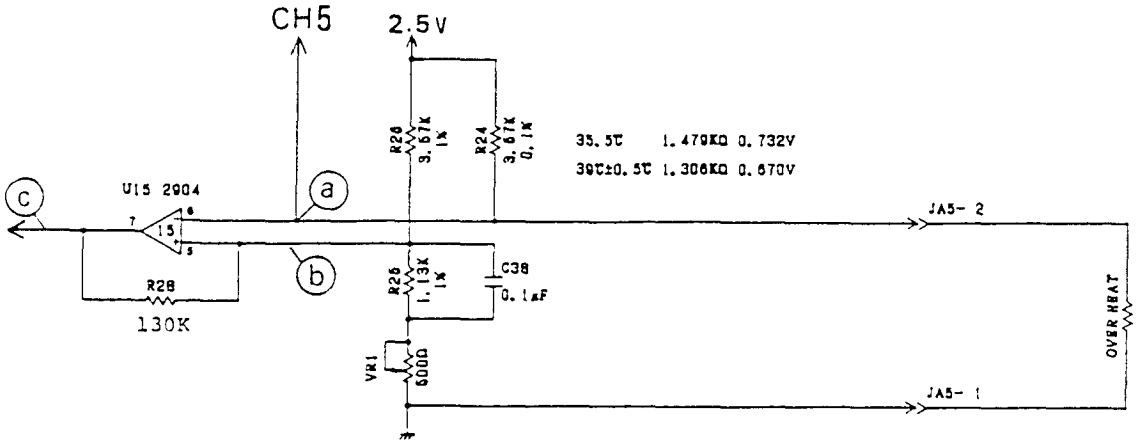
1. When the sensor detects the incubator air temperature at or over 39.0°C, the incubator air temperature sensor judges that an over-temperature condition exists and activates the over-temperature alarm.

2. The over-temperature detection sensor, which is independent of the CPU-controlled temperature measurement circuit, activates the over-temperature alarm when the sensor detects an alarm condition at 39.5 +/- 0.5˚C.
In this case, both the audible and visual alarms will be automatically reset when the air temperature is felt by the sensor to have fallen by 2-3˚C from the alarm temperature level.

The temperature information obtained by the over-temperature sensor is sent as voltage information to CPU via CH5.

When the over-temperature detection sensor becomes activated, the relay (K2) on the 8302G board will go OFF and the heater output will be interrupted.

Ref.) The over-temperature detection level is adjusted with VR1. Refer to 11. Over-Temperature Adjustment for procedures.



(Test Point) * a ... If virtual resistance (1k～2kΩ) is inserted in the sensor section, specified voltage divided by R25, R26 and VR1 is fed to CH5.

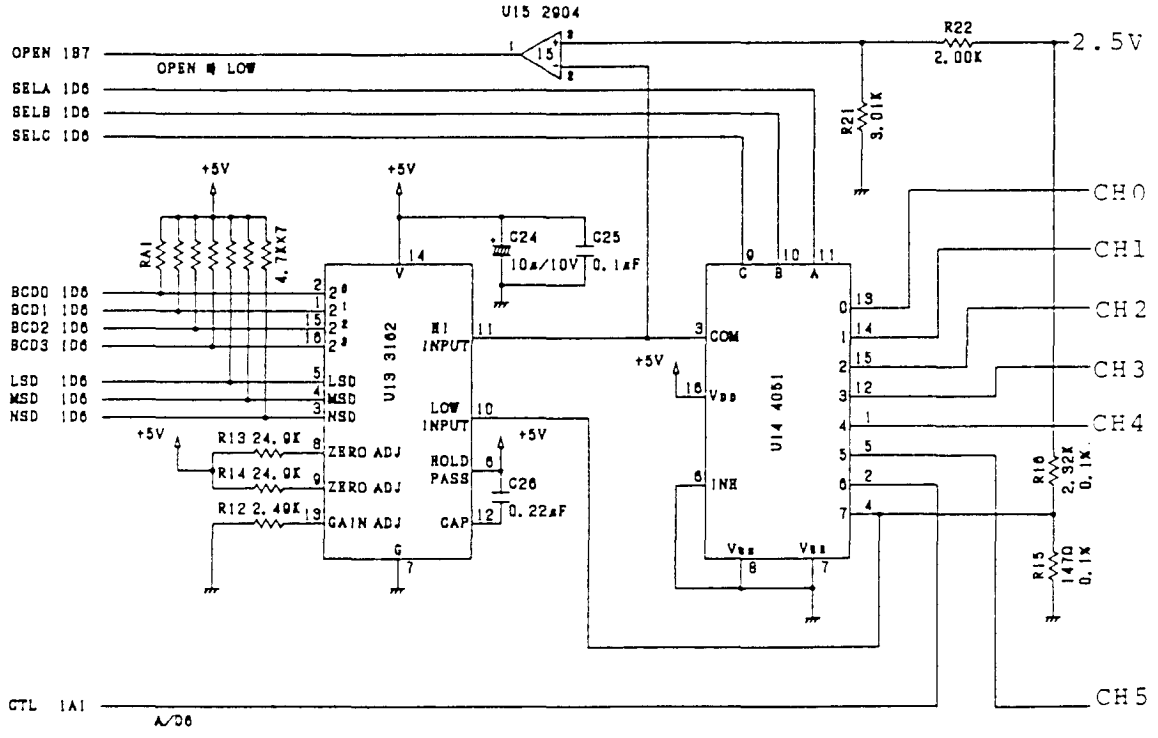
* b ... 0.6 - 0.78V

* c ... Goes high (+5V) in over-temperature conditions (Point a < Point b).

6-3 A/D converter circuit

Temperature data inputted by each temperature sensor are switched over by 8CH multiplexer (U14) and digitally inputted to CPU via 10 bit A/D converter (U13).

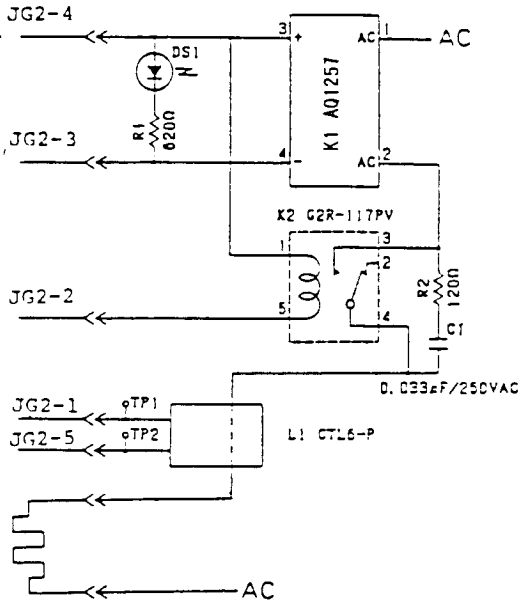
The analogue voltage inputted by a sensor will vary within the range of 0.15 - 1.15V in normal conditions. Should the sensor be disconnected, 2.5V will be inputted, or should it be shorted, 0V will be inputted. (In the case of CH4, 0V for disconnection and 2.5V for short.) U15 will output 0V in case of sensor disconnection, while CPU will recognize a shorted sensor and give an alarm.



6-7 Heater output / heater current detection circuit

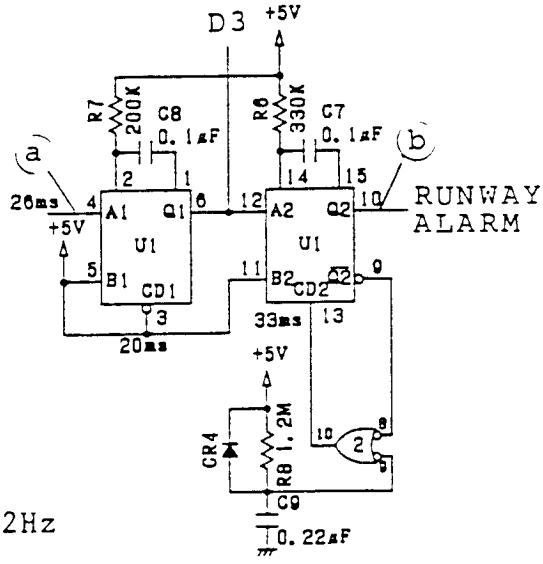
CPU outputs heater output control signals via U6 (81C55) port to control K1 (SSR) on 8302G board.

The same output is fed back to CPU by the current sensor (L1) to monitor a trouble developed on SSR, the heater, etc.



6-8 CPU runaway detection circuit

Should any trouble develop on CPU and the program be in runaway conditions, an alarm will be immediately given, and the heater power will be disconnected.

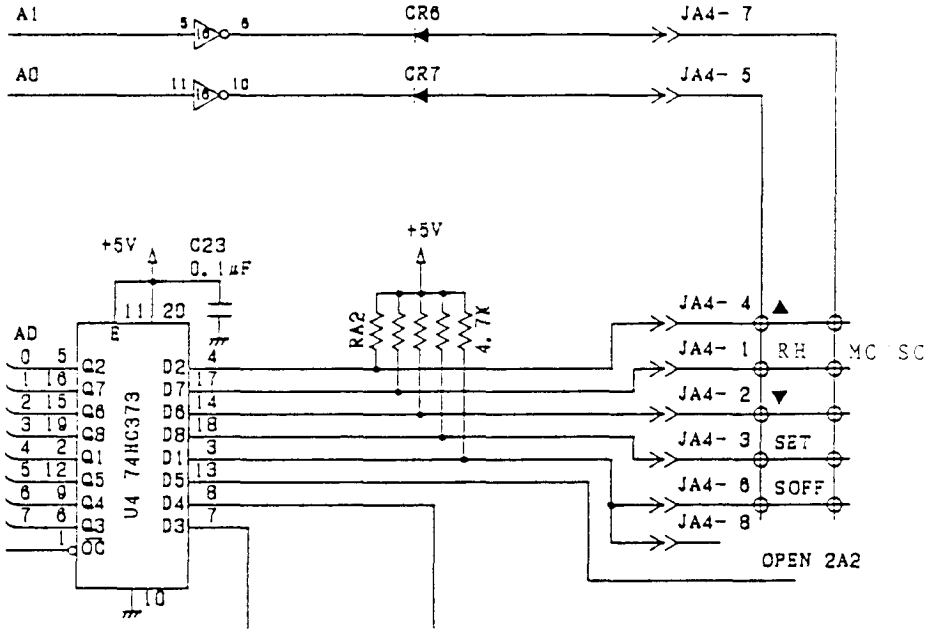


(Test Point)

* a ... During normal operation 32Hz
* b ... During normal operation +5V
  During trouble 0V

6-4 Key input circuit

When a key switch incorporated in 8302B board is pressed, 8 bit latch (U4) will input the key information to CPU via AD 0 - 7.

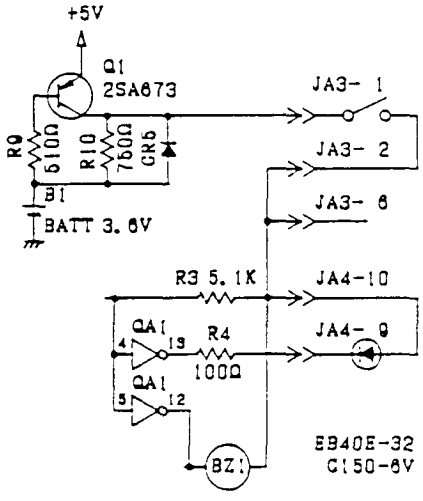


6-5 Display unit

Temperature information, control status and other data processed by CPU are displayed on LED on the front panel.

6-6 Power failure detection / battery charge circuit

The unit has an internal Ni-Cd battery for an audible alarm and LED display during power failure. A power fialure alarm will be given if AC power is not supplied even though the power switch is depressed.



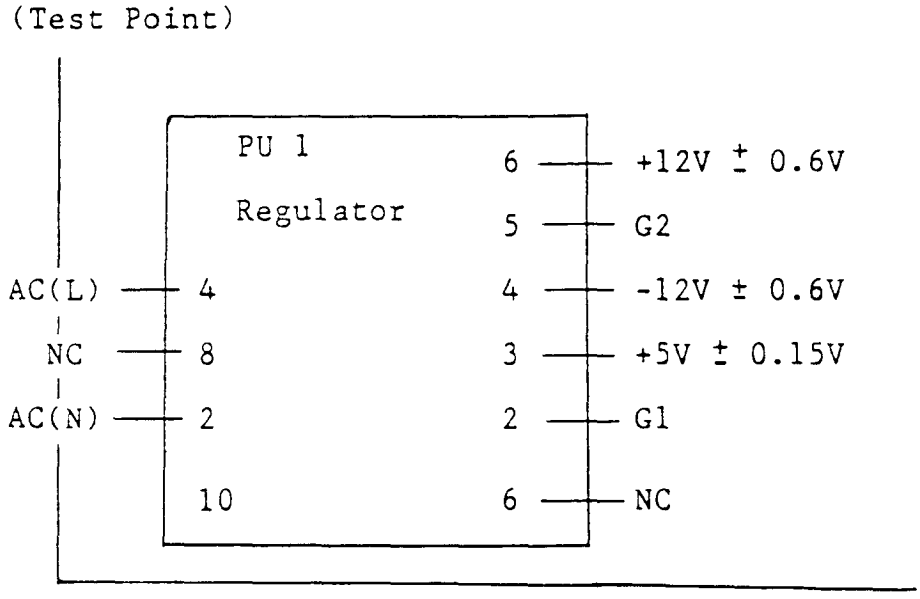
6-9 Data backup with EEPROM

When the unit is turned off, function setting backup and correction values for respective sensors will be retained.

Note) As data stored in each EEPROM on 8302A board (CPU board), 8302D board (Sensor unit board) or 8302E board (Skin temperature probe board) correspond to each instrument or sensor, sensors or EEPROM cannot be replaced.

6-10 DC +5V, ±12V regulator

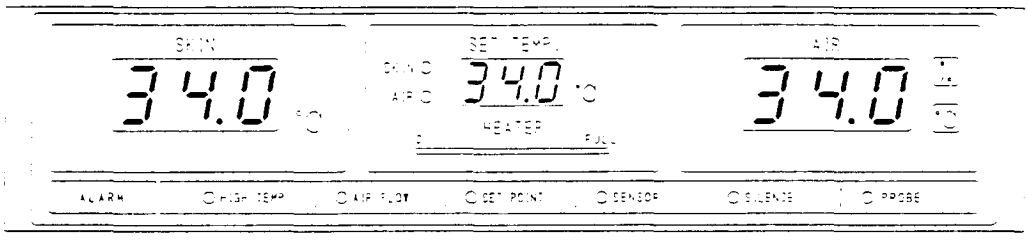
The unit is provided with DC +5V, ±12V by PU1.
DC +5V is used for most circuitry. Should any trouble develop on this voltage, all operation of the unit will be affected.



7. Function Test 2 (Internal Test with Display)

7-1 Display test

When the unit is turned on, it goes through a self-diagnostic LED test on the display.



(Test Point)

* Neither nor LED display is on.

.....> Check AC power switch, DC±12V, +5V, and the connector.

Faulty LED unit

* LED segment is missing.

.....> Faulty LED unit.

* LED display is not normal, and a power failure alarm is given.

.....> CPU runaway. If the situation is not corrected even when the unit is started again, total malfunction is suspected.

7-2 Sensor test

Sensors are checked for malfunction while the unit is in operation.

(Test Point)

* A sensor alarm occurs and LED displays (temperature) are all blank.

  ....> Defective sensor unit.
  Defective cable.
  Connector off.

* A sensor alarm occurs, and incubator air temperature, RH displays go LO or HI.

  ....> LO means sensor input line disconnection;
  HI means short circuit.

* A sensor alarm occurs, but temperature displays are normal.

  ....> Either the over-temperature sensor or the air flow sensor is disconnected or shorted.

* In SC mode, a probe alarm occurs and temperature displays are all blank.

  ....> Connector is off.
  Defective probe.

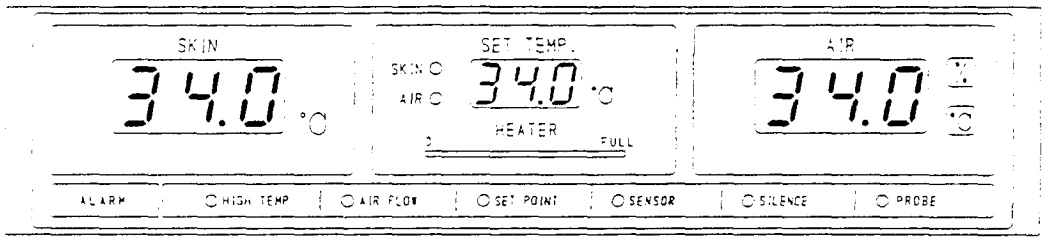
* In SC mode, a probe alarm occurs and temperature displays indicate either LO or HI.

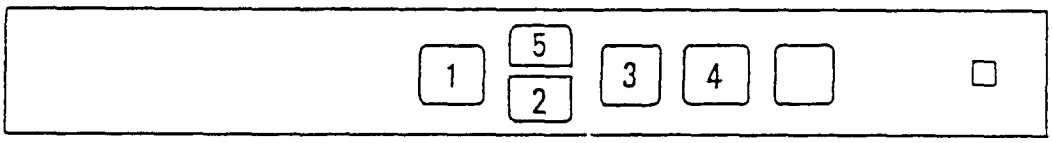
  ....> LO means short;
  Hl means disconnection.

8. Function Test 3 (Special Internal Test via Keyboard)

Special operation of the keyboard permits monitoring and checking the function of A/D converter and the condition of internal air circulation in the V-85 Infant Incubator.

Good care must be taken. An accidental misoperation may destroy the ability of the incubator to function.





8-1 Test mode 1 (A/D converter, internal air circulation, others)

* Setting

Turn the power switch on while depressing Panel Switch 2 (⬇). Hold Switch 2 until the self-diagnosis program is completed. Test Mode 1 is selected when CH.0 is indicated on the SET TEMP display.

* Operation

Once Test Mode 1 is selected, depress Panel Switch 1 (setting switch), and the SET TEMP display will go through a sequence of CH.0 → CH.1 → CH.2 → CH.3 → CH.4 → CH.5 → CH.6

→CH.7→OP→FA→SE→So→H7→V1→V2→Pd→CH.0→ ...

CH.0 —DH7 indicate the contents of A/D converter, Fa indicates the flow of air, SE indicates a defective sensor, So indicates a disconnected sensor, H7 indicates the temperature of the RH sensor, V1 and V2 each indicates a program version, and Pd indicates the date of programming.

Depress Panel Switch 5 (↑), and appropriate data will appear on the SET TEMP display for CH0-7, OP, FA, SE, So, H7, V1, V2 and Pd.

(Refer to the following description for details of data.)

* To stop the test procedure:
  Turn the power switch off and then on.

** ANALYSIS OF DATA IN TEST MODE				
1. Turn the power switch on. Turn Switch 2 (↓) on. LED Test. ↓				SET TEMP display CH.0
2. Set Test Mode 1.				
SW1	Dis-play 1	SW5	Dis-play 2	
ON↓	CH.0	ON → ←	590	* Status of skin temperature probe 999 ... Probe disconnected -99 ... Probe shorted

ON↓	CH.1	ON → ←	580	* Status of incubator air temperature sensor 999 ... Probe disconnected -99 ... Probe shorted
ON↓	CH.2	ON → ←	580	(No meaning here.)
ON↓	CH.3	ON → ←	580	* Status of RH sensor 999 ... Probe disconnected -99 ... Probe shorted
ON↓	CH.4	ON → ←	645	* Status of air flow sensor -99 ... Probe disconnected 999 ... Probe shorted
ON↓	CH.5	ON → ←	630	* Status of over-temperature sensor 999 ... Probe disconnected -99 ... Probe shorted
ON↓	CH.6	ON → ←	120	* Status of current sensor -99 ... Heater output is zero.
ON↓	CH.7	ON → ←	0	* A/D converter ground 0±1 : normal others: defective interface
ON↓	OP	ON → ←	32.2	(No meaning here.)
ON↓	FA	ON → ←	-40	* Status of internal air circulation -40±10 (stabilized): normal over zero: alarm conditions
	Ref.) Alarm conditions will occur frequently if internal air circulation is not initially set to be normal. Refer to Section 10 for performing initial setting of internal air circulation.			

ON ↓	SE	ON → ← OFF	150	* Indicates a defective sensor. 1 ... defective BIT 7 6 5 4 3 2 1 0 — incubator air temeprature └over-temperature └air flow └RH └sensor unit off └skin temperature └skin temperature probe off
ON ↓	So	ON → ← OFF	214	* Sensor disconnected 1 ... Disconnected BIT 7 6 5 4 3 2 1 0 — incubator air temperature └over-temperature └air flow └RH └sensor unit off └skin temperature └skin temperature probe off
ON ↓	H7	ON → ← OFF	365	* Temperature sensed by RH sensor (x10)
ON ↓	U1	ON → ← OFF	003	* Program version 1 003··· V03, 700 (1994/8)
ON ↓	U2	ON → ← OFF	700	* Program version 2 700··· V03, 700 (1994/8)
ON ↓	Pd	ON → ← OFF	408	* Date of programming

Ref.) * The A/D converter values displayed in CH.0-3 are those of the test simulator (36.0°C) ±15. The test simulator should be calibrated correctly.)

* The values displayed in CH4 and CH5 are obtained in stabilized conditions with the incubator air temperature at 34.0 ±2°C.

* A defective or disconnected sensor is indicated decimally. Conditions of each sensor are known by converting the decimal system into the binary system.

Ex) SE (defective sensor) Displayed value D = 150 ...
binary system (10010110)

Content ... Skin temp probe off;
air flow sensor, over-temp
sensor defective.

Ex) So (disconnected sensor) Displayed value D = 198 ...
binary system (11010110)

Content ... Skin temp probe off; skin temp
sensor, air flow sensor, over-temp
sensor disconnected.

Judging from the displayed values of Se and So, the skin temp sensor must be disconnected due to the skin temp probe off. (In case of MC nothing is wrong as no skin temp sensor is attached.)

A defective air flow sensor and a defective over-temperature sensor both mean that the sensors are disconnected, probably their connectors on the same line are off.

Example of calculation

150 ÷ 2 = 75 ... 0, 75 ÷ 2 = 37...1, 37 ÷ 2 = 18...1,
18 ÷ 2 = 9...0, 9 ÷ 2 = 4...1, 4 ÷ 2 = 2...0,
1 ÷ 2 = 0...1

Put the underlined figures together one after another beginning with the rightmost position, and you'll get 10010110.

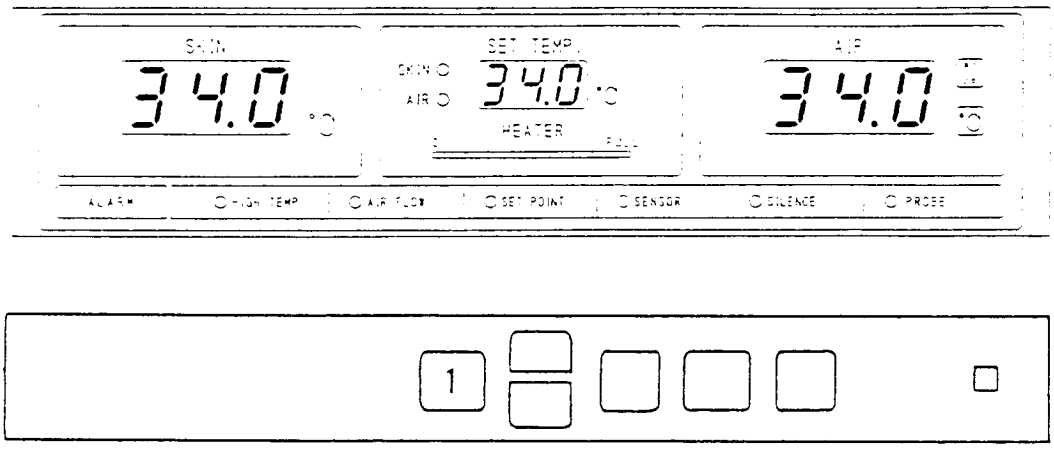
8-2 Test Mode 2 (over-temperature test)

In this test mode, the incubator air temperature can be set to 39.5°C with MC.

* Setting

Turn the power switch on while depressing Panel Switch 1 (setting). Hold Switch 1 until the self-diagnosis program is completed.

Test Mode 2 (over-temperature test) is selected when the incubator air temperature setting reads 39.5°C.



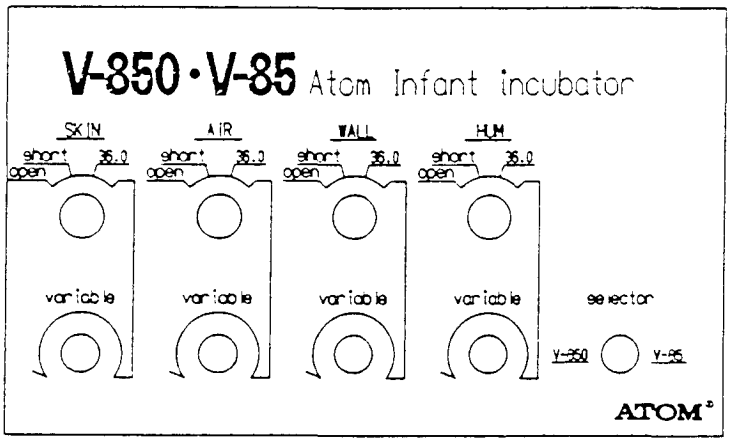
(Test Point)

* Verify that an over-temperature alarm is given when the incubator air temperature reaches 39.5±0.5°C.

Ref.) Refer to Section 11 for adjustment.

9. Function Test 4 (Test with Simulator)

Perform simulation of the control unit using the V-850/V-85 test simulator. The selector switch on the test simulator should be tilted down to the V-85 side.



9-1 Sensor open test

Set the rotary switch of each sensor to "open" to simulate the situation where the sensor is disconnected.

(Test Point) * The heater stops.

* The value indicated by each sensor (L0) flashes.

* AD converter indicates 999 in Test Mode 1.

9-2 Sensor short test

Set the rotary switch of each sensor to "short" to simulate the situation where the sensor is shorted.

(Test Point) * The heater stops.

* The value indicated by each sensor (H1) flashes.

* AD converter indicates -99 in Test Mode 1.

9-3 36.0°C Test

Set the rotary switch of each sensor to "36.0°C" to verify that the sensor indicates 36.0°C ± 0.2°C.

Note) Test Box 1 should be calibrated correctly.

(Test Point) * 36.0 ± 0.2

* AD converter indicates 580±15 in Test Mode 1.

9-4 Simulation test

Set the rotary switch of each sensor to simulated sensor drive to verify the operation of the control unit.

10. Initialization of Internal Air Circulation

To detect any abnormalities in the internal air circulation, the conditions of internal air circulation stabilized at the reference ambient temperatures (30°C, 34°C, 37°C) are stored in the control unit. Should the fan motor stop or should any abnormality develop at the air outlet or inlet of the internal air circulation system, and internal circulation be disturbed, an alarm will occur.

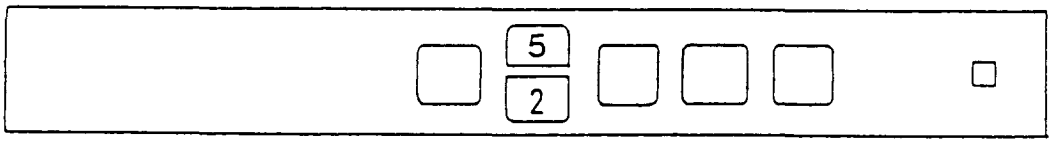
Improper initialization of internal air circulation may cause abnormalities in the internal air circulation not to be detected properly.

° In such a case, it is necessary to re-initialize.

(Test Point) * Check that the unit is set properly. If the value shown of internal air circulation in Test Mode 1 is whithin the range of -30 to -50, the unit is set properly. However, if it is -10 or above, it is necessary to re-initialize.

10-1 Initialization Technique

Special operation of the keyboard enables you to perform initial setting of the internal air circulation system. Utmost care should be taken as this intentional misoperation might destroy internal functioning of the incubator.



* Preparation of setting 1.

... Set the unit (access port, mattress platform, etc) securely. Fill the humidity reservoir with water to a specified level and set the adjusting lever to high humidification.

Note) The unit, once set, cannot be reset until the initial setting of the internal circulation system is completed. Should any procedure be done on the unit in the meantime, initial setting may not be performed properly.

* Preparation of setting 2

... Turn the power switch on while depressing Panel Switch 2 (▼) and 5 (▲) simultaneously. Hold Switch 2 and 5 until the self-diagnosis program is completed.

Initial setting of internal circulation is started when the SET TEMP display reads F30.

* During initial setting

... The incubator air temperature changes automatically from 30 through 34 to 37°C. Stabilized conditions of internal circulation at each temperature range are memorized.

* Setting completed

... Initial setting of internal circulation is completed when the SET TEMP display reads END.

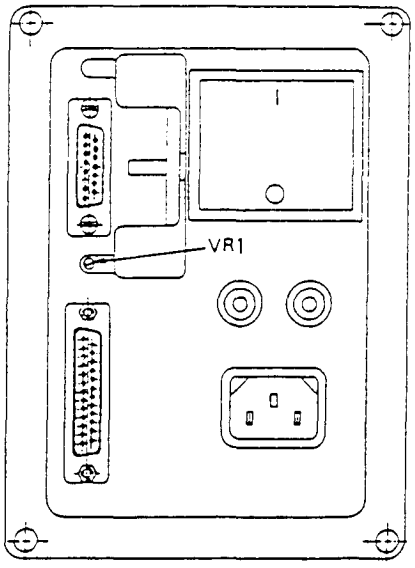
The incubator air temperature will be set and controlled at 34°C thereafter.

Note) Should initial setting be interrupted, conditions before setting will be retained. Should initial setting be completed and stopped simultaneously, it cannot be said for sure that such initially set values have been accepted by the control unit. Therefore, repeat initial setting.

11. Over-temperature Adjustment

Adjust VR1 on the over-temperature detection circuit (6-2) in the same way as in 8-2 Test Mode 2 (over-temperature test).

VR1 is accessed at the sensor connector lock key section on the power switch mounting panel on the side of the power unit.



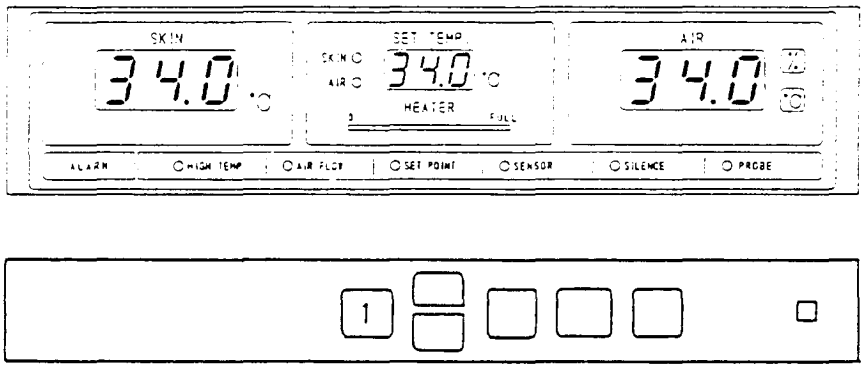
* Preparation of operation 1

  ... Turn VR1 fully clockwise (so that an over-temperature alarm may not be given when the incubator air temperature rises to 39.5°C).

* Preparation of operation 2

  ... As in 8-2 Test Mode 2, turn the power switch on while depressing Panel Switch 1 (setting), and hold Switch 1 until the self-diagnosis program is completed.

  Test Mode 2 (over-temperature test) is selected when the incubator air temperature setting reads 39.5°C.



* VR1 adjustment

... When the incubator air temperature stabilizes at 39.5°C, turn VR1 slowly counterclockwise until an over-temperature alarm is given.

* Verification

... Turn the power switch off, lower the incubator air temperature and cancel the alarm. Select Test Mode 2 again and raise the incubator air temperature toward 39.5°C to verify that an over-temperature alarm is given with the incubator air temperature at 39.5 ±0.5°C.

LIST OF ALARMS ON V-85 INFANT INCUBATOR

Alarm Function	Alarm Condition	Delay Time	Heater output	Flashing/ Intermittent Sound	Flashing/ Continuous Sound	Illuminated /Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Internal Air Circulation	Motor has stopped, fan isn't attached, air inlet or air outlet blocked, or any other trouble has developed within the air circulation system (except during warming-up).	Within 15 min.	Off	○	-	-	-	Resetting is unconditionally possible. The Internal Air Circulation Alarm will be disabled for 15 minutes after it is reset.	-
Over-Temperature	Incubator air temperature is 39.5 ± 0.5°C	Immediately	Off	○ (Incubator air temperature indicator display figure flashes.)	-	-	Within the range of 34.0 - 37.0°C.		-
Power Failure	Power failure, disconnected power plug, broken power cable, actuation of circuit breaker, etc.	Immediately	-	-	-	○	-	-	-

Alarm Function	Alarm Condition		Delay Time	Heater output	Flashing/ Intermittent Sound	Flashing/ Continuous Sound	Illuminated /Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Pre-selected Temperature (The alarm function will be enabled once the normal range is reached. An alarm will be given if more than 50 min. is over before the normal range is reached.)	Skin Temperature	Skin temperature is above pre-selected temperature by more than 1°C.	Within approx. 12 seconds	off	-	○ (Skin temperature indicator display figure flashes)	-	○	-	○
		Skin temperature is below pre-selected temperature by more than 1°C.	Within approx. 12 seconds	Unchanged	○ (Skin temperature indicator display figure flashes.)	-	-	○	-	○
	Incubator air temperature	Incubator air temperature is above pre-selected temperature by more than 1.5°C.	Within approx. 12 seconds	off	-	○ (Incubator air temperature indicator display figure flashes.)	-	○	-	○
		Incubator air temperature is below pre-selected temperature by more than 3°C.	Within approx. 12 seconds	Unchanged	○ (Incubator air temperature indicator display figure flashes.)	-	-	○	-	○
>37°C	Incubator air temperature is over 37.0°C.		Immediately	Unchanged	-	-	○ An audible alarm will sound for 2 seconds when the indicator lamp is illuminated.	○	-	-

Alarm Function	Alarm Condition	Delay Time	Heater Output	Flashing/ Intermittent Sound	Flashing/ Continuous Sound	Illuminated /Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Temperature Sensor	Incubator air temp sensor, Over temp sensor, Air flow sensor, RH sensor — shorted	Immediately	off	-	○ Defective sensor display figure and indicator flash.	-	-	When the unit has returned to normal conditions.	-
	Incubator air temp sensor, Over-temp sensor, Air flow sensor, RH sensor — disconnected or connector is not properly connected.	Immediately	off	○ Defective sensor display figure and indicator flash.	-	-	-	When the unit has returned to normal conditions.	-
Skin temperature probe	Shorted	Immediately	off	-	○ Skin temperature display figure and indicator flash.	-	-	When the unit has returned to normal conditions.	-
	Disconnected or connector is not properly connected.	Immediately	off	○ Skin temperature display figure and indicator flash.	-	-	-	When the unit has returned to normal conditions.	-

Alarm Function	Alarm Condition	Delay Time	Heater Output	Flashing/ Intermit-tent Sound	Flashing/ Continuous Sound	Illuminated /Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Heater Discon-nected	Heater is disconnec-ted, relay is defec-tive, connector is not properly connected, etc.	Immediately	off	Heater indicator flashes.	-	-	-	When the unit has returned to normal conditions.	-

13. Troubleshooting

13-1 When power switch to turned on

*1 No operation →

LED unit signal line off.

(CPU,,heater, etc. are controlled properly, but no display)

Power isn't supplied, but no power failure detection.

a. Connector in power unit is off.
b. Check power failure detection circuit.

*2 Power failure alarm occurs →

AC power isn't supplied.

DC power isn't supplied.

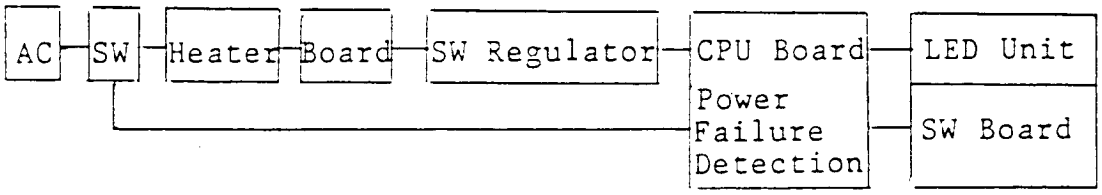
a. Power cord off.
b. Connector in power unit is off.

*3 Power failure alarm occurs LED display abnormal →

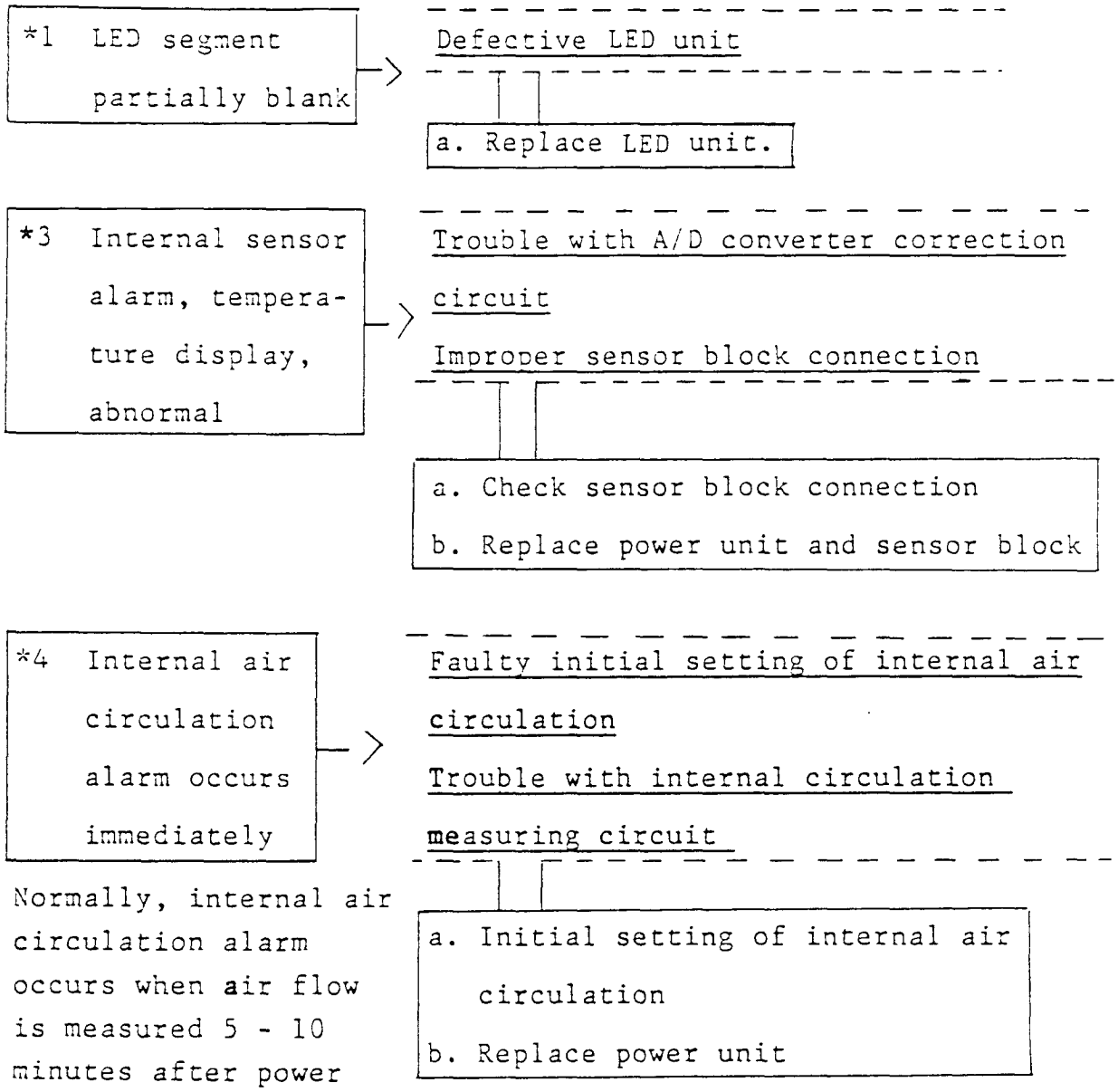
CPU runaway

* Turn off power then on .. OK?

a. Check power unit totally.

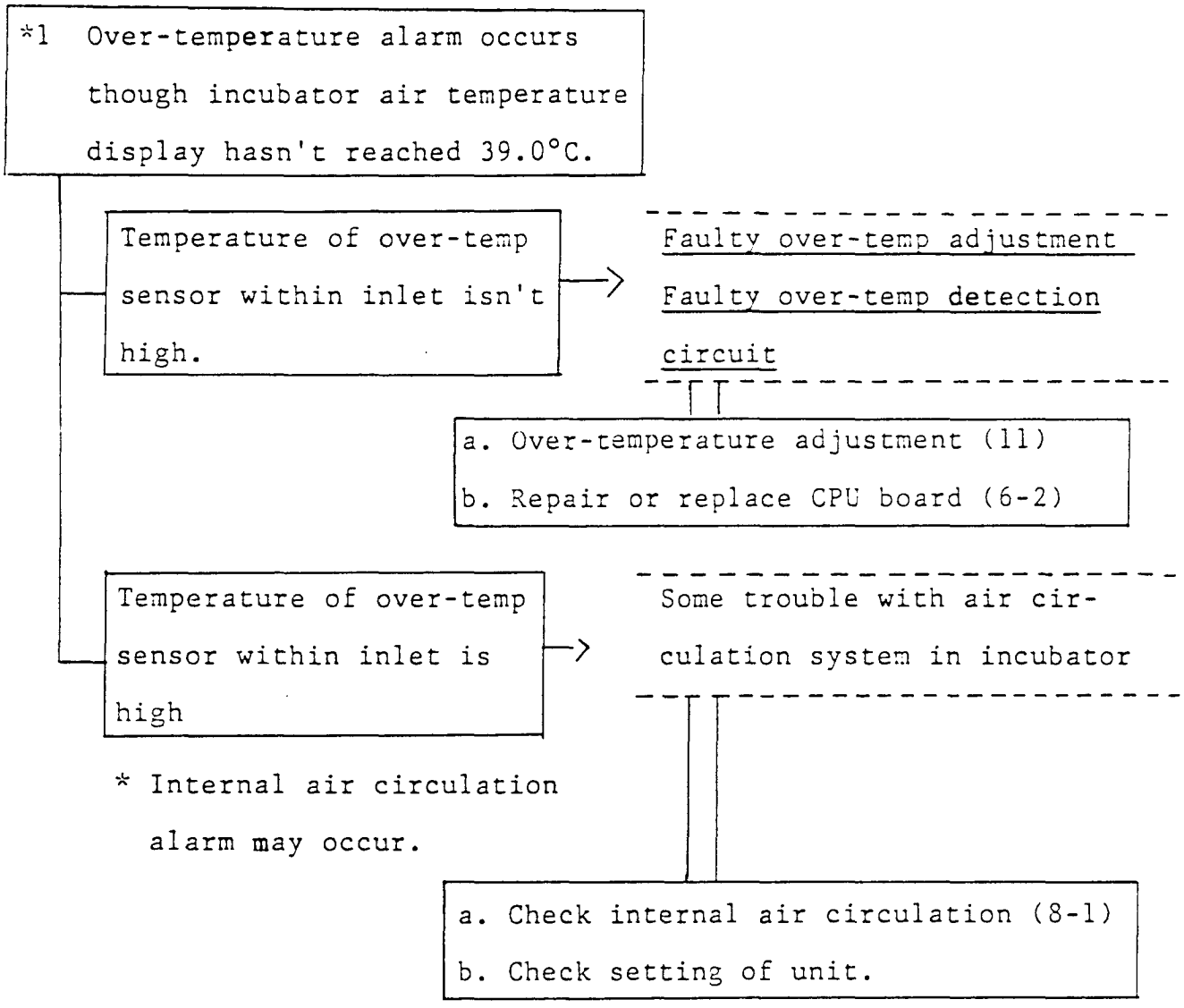


13-2 Immediately after self-diagnosis test


*1 LED segment partially blank
Defective LED unit
a. Replace LED unit.
*3 Internal sensor alarm, temperature display, abnormal
Trouble with A/D converter correction circuit
Improper sensor block connection
a. Check sensor block connection
b. Replace power unit and sensor block
*4 Internal air circulation alarm occurs immediately
Faulty initial setting of internal air circulation
Trouble with internal circulation measuring circuit
a. Initial setting of internal air circulation
b. Replace power unit

Normally, internal air circulation alarm occurs when air flow is measured 5 - 10 minutes after power is turned on.

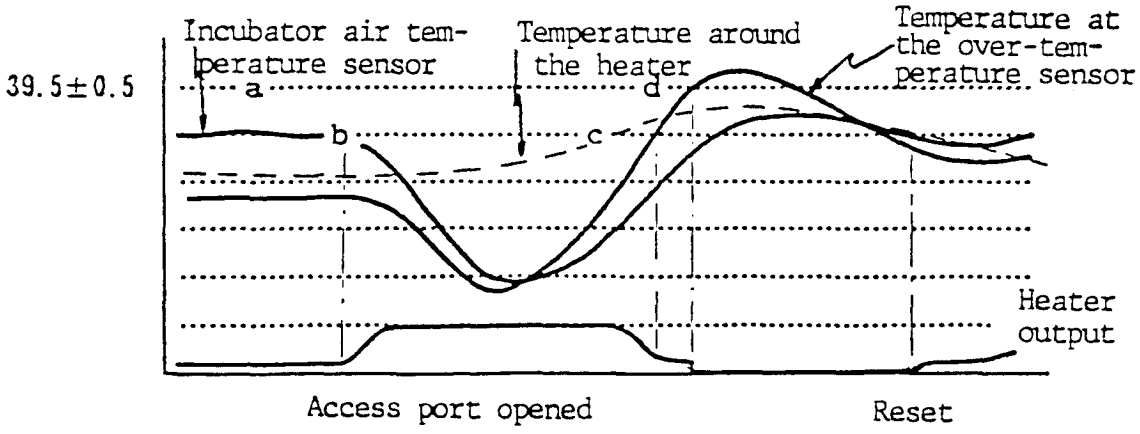
13-3 Over-temperature alarm


*1 Over-temperature alarm occurs though incubator air temperature display hasn't reached 39.0°C.
Temperature of over-temp sensor within inlet isn't high.
Faulty over-temp adjustment
Faulty over-temp detection circuit
a. Over-temperature adjustment (11)
b. Repair or replace CPU board (6-2)
Temperature of over-temp sensor within inlet is high
Some trouble with air circulation system in incubator
* Internal air circulation alarm may occur.
a. Check internal air circulation (8-1)
b. Check setting of unit.

Note) The following is an example in which an over-temperature alarm occurs:

Following stabilized control (a), an access port was opened for treatment or other reasons (b). The temperature at the incubator air temperature sensor dropped, and the heater output was increased to compensate for the loss. Thus only the temperature around the heater was

raised (c). When the access port was closed, excessive heat raised the incubator air temperature temporarily, the Temperature at the over-temperature sensor near the heater was raised into the over-temperature detection range, and thus an alarm was given (d).



13-4 Internal air circulation alarm

*1 Internal air alarm occurs immediately after power is turned on. → See 14-2

*2 Alarm occurs →

Trouble with internal air circulation.

a. Anything to disturb internal air circulation?

(Check Point)

* Is fan motor active? Attached?
* Isn't air inlet or outlet blocked?
* Are incubator deck, hood, etc. properly installed?
* Is humidity reservoir properly installed?

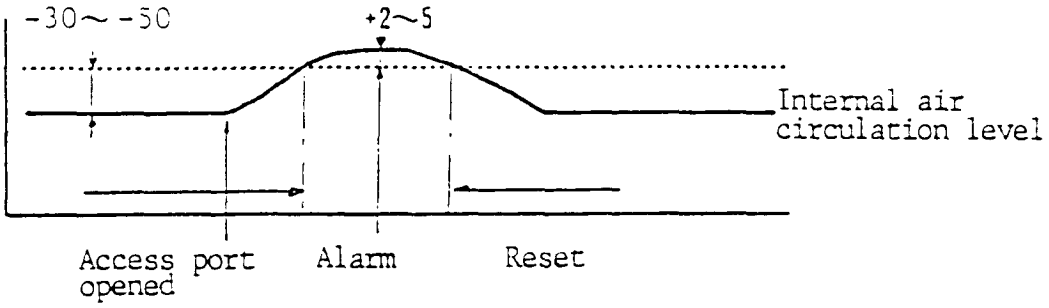
*3 Alarm occurs →

Trouble with internal air circulation.

a. Isn't internal air circulation disturbed?

(Check Point)

* Sudden air flow disturbance and temperature change due to opened access ports might cause an alarm (8-1).



*4 Alarm occurs →

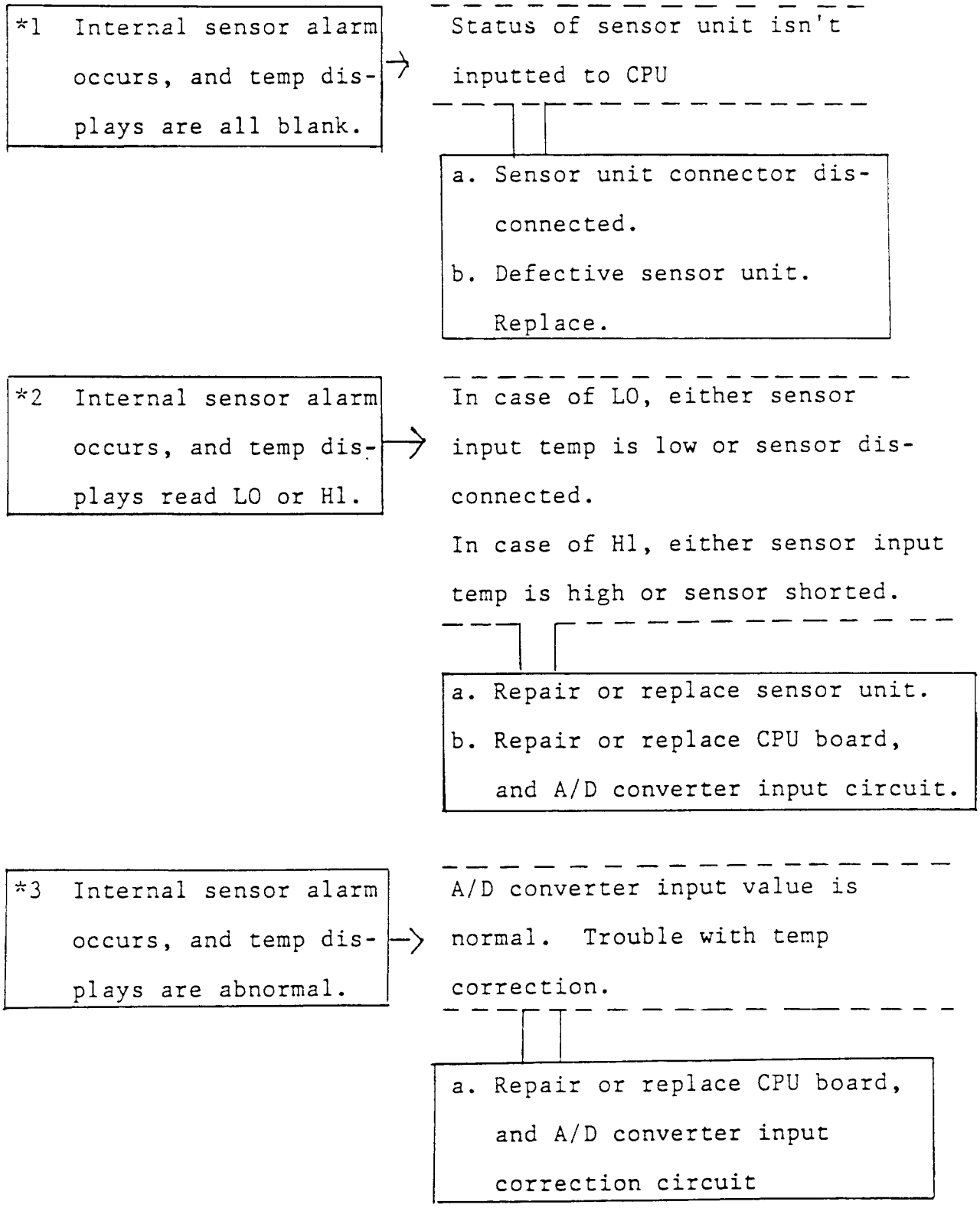
Faulty initial setting of internal air circulation

Trouble with internal circulation measuring circuit

a. Initial setting of internal air circulation (10)

b. Replace power unit

13-5 Internal sensor alarm


*1 Internal sensor alarm occurs, and temp displays are all blank.
Status of sensor unit isn't inputted to CPU
a. Sensor unit connector disconnected.
b. Defective sensor unit. Replace.
*2 Internal sensor alarm occurs, and temp displays read LO or Hl.
In case of LO, either sensor input temp is low or sensor disconnected.
In case of Hl, either sensor input temp is high or sensor shorted.
a. Repair or replace sensor unit.
b. Repair or replace CPU board, and A/D converter input circuit.
*3 Internal sensor alarm occurs, and temp displays are abnormal.
A/D converter input value is normal. Trouble with temp correction.
a. Repair or replace CPU board, and A/D converter input correction circuit

Ref.) 8. Function Test 3

13-6 Others

*1 Heater output display flashes. Alarm occurs.

Specified heater output isn't supplied.

a. Heater output connector disconnected.
b. Defective heater board or defective CPU board.
c. Heater disconnected.

*2 Temp and other sensors malfunction

External factor

a. Is sensor free from spills, dust, scar, etc. ?
b. Check power unit totally.

14. Reporting of Trouble

Should any trouble develop on V-85 Infant Incubator and repair be requested or inquiry made, please report to your repair department following the example of a report form given below to help inquire into possible causes of trouble.

* Trouble Report

Name of Hospital		Date	
Description & No. of Unit		No. of Power Unit	
Details of Trouble			
Factors Related to Trouble Reported			
1. Servo/Manual		2. Pre-selected Temperature	
3. Patient's Skin Temperature		4. Incubator Air Temperature	
5. RH			
7. Alarm			
8. Values Obtained in Test Mode 1.			
0ch		OP	
1ch		FA	
2ch		SE	
3ch		So	
4ch		H7	
5ch		V1	
6ch		V2	
7ch		Pd	
		Reported by	

ATOM MEDICAL AUSTRALIA PTY. LTD.
P.O. BOX 22
EASTERN MAIL CENTRE, VIC. 3110
AUSTRALIA
PH.: (03) 873 5822 FAX: (03) 873 5911

Replacement Parts List

V-85 SC·MC
Atom Infant Incubator

ATOM MEDICAL CORPORATION

CONTENTS

Exploded view showing all the parts 1

Hood assy 3

Front door assy 5

Main deck assy 7

Incubator base assy 9

Power unit assy (Front) 12

Power unit assy (Rear) 14

Cabinet assy 17

Consumables/Accessories 19

Fig.1 Exploded view showing all the parts

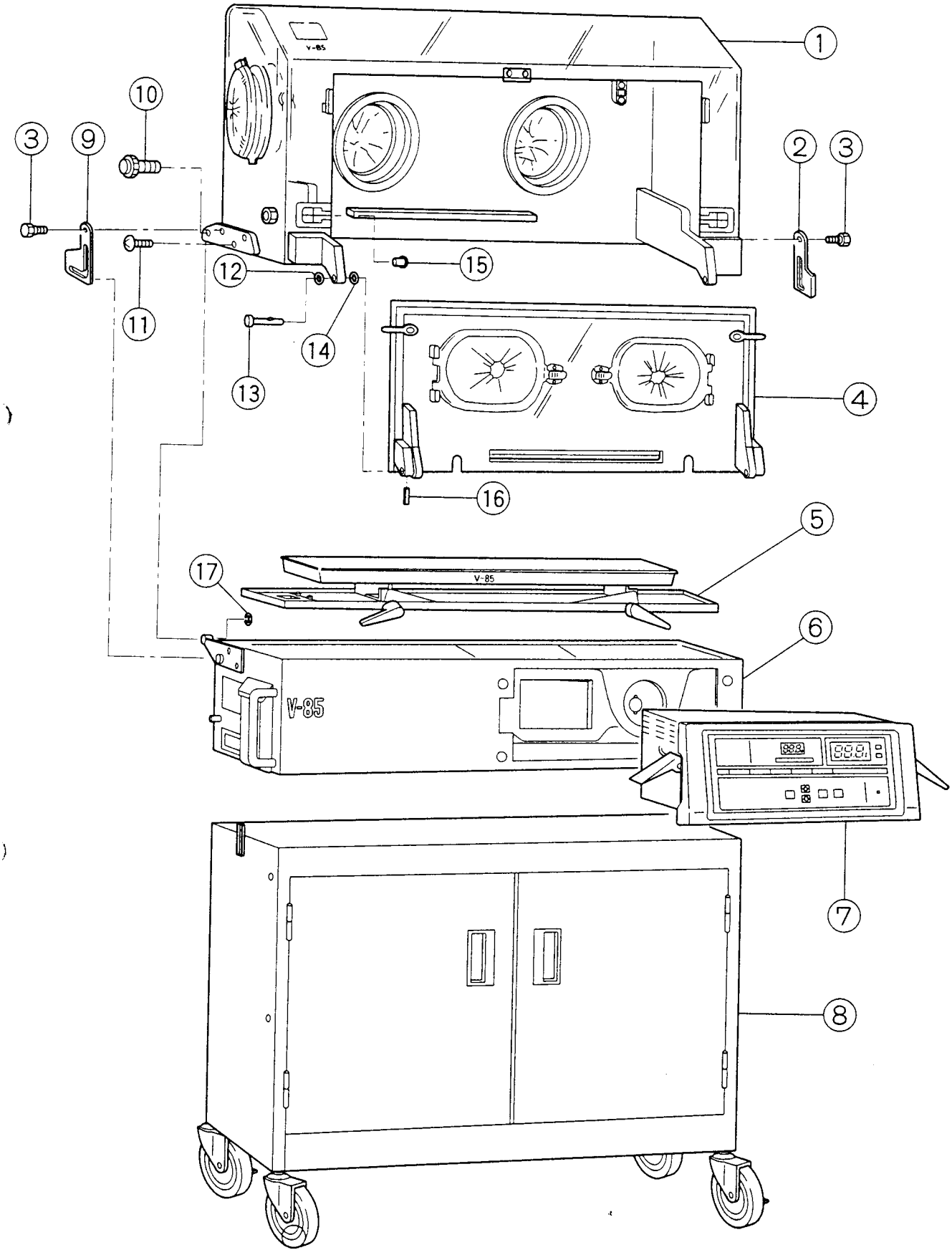


Fig.1 Exploded view showing all the parts

Fig.-No.	Part Name	Part No.
1 - 1	Hood assy (SC)	C40-001
	(MC)	C41-001
1 - 2	Hood stopper (Righgt)	C23-003
1 - 3	Stopper holder (B)	C012550
1 - 4	Front door assy	C40-002
1 - 5	Main deck assy	C400320
1 - 6	Incudator base assy	C400220
1 - 7	Power unit assy (SC)	C400420
	(MC)	C410420
1 - 8	Cabinet assy	C230520
1 - 9	Hood stopper (Left)	C022070
1 - 10	Stopper holder (A)	C011560
1 - 11	Truss head screw, M6×15	V013961
1 - 12	Washer φ6.1×φ12×t0.5	X033008
1 - 13	Front door fixing axis	C401090
1 - 14	Washer φ6×φ12×t1.0	X033038
1 - 15	Hinge retaining nut	C231120
1 - 16	Hexagon socket set screw, M4×6	V125101
1 - 17	E ring, E6	V091094

Fig.2 Hood assy

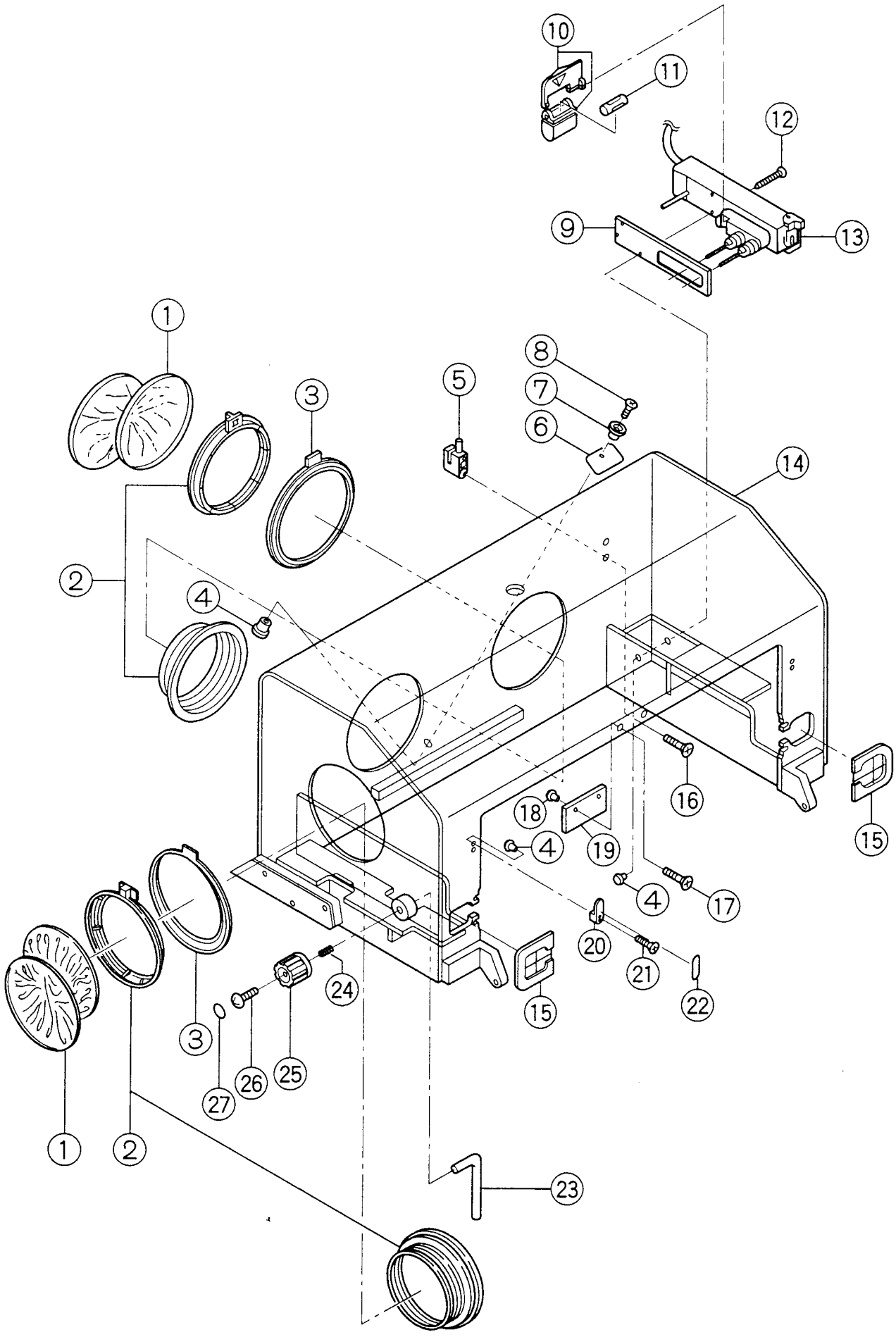


Fig.2 Hood assy

Fig.-No.	Part Name	Part No.
2 - 1	Access port cover (10/set)	2300161
2 - 2	Access port	C23-015
2 - 3	Access port fixing packing	C011490
2 - 4	R flange nut	C231280
2 - 5	High oxygen administration indicating plate hanger	C23-008
2 - 6	I.D. card (50/set)	C23-009
2 - 7	I.D. card hock	C011500
2 - 8	Round flat-head screw, M3×8	V015271
2 - 9	Sensor block packing	C232070
2 - 10	Water chamber	C23-010
2 - 11	Wet-bulb water sterilizing adapter	2302011
2 - 12	Round head screw, M3×30	V011372
2 - 13	Sensor block assy(SC)	C40-003
	(MC)	C41-002
2 - 14	Hood	C40-004
2 - 15	Tube inlet packing	C401140
2 - 16	Truss head screw, M4×10	V012441
2 - 17	Truss head screw, M4×8	V013431
2 - 18	Setscrew(for front door retaining plate)	C011340
2 - 19	Front door retaining plate	C011330
2 - 20	Lock knob holder	C011350
2 - 21	Flat head screw, M3×15	V014311
2 - 22	Lock knob holder plate	C239306
2 - 23	Humidity control arm	C401110
2 - 24	Push spring	X150032
2 - 25	Humidity control knob	C401120
2 - 26	Flat head screw, M3×8	V015271
2 - 27	Humidity control knob plate	C409303

Fig.3 Front door assy

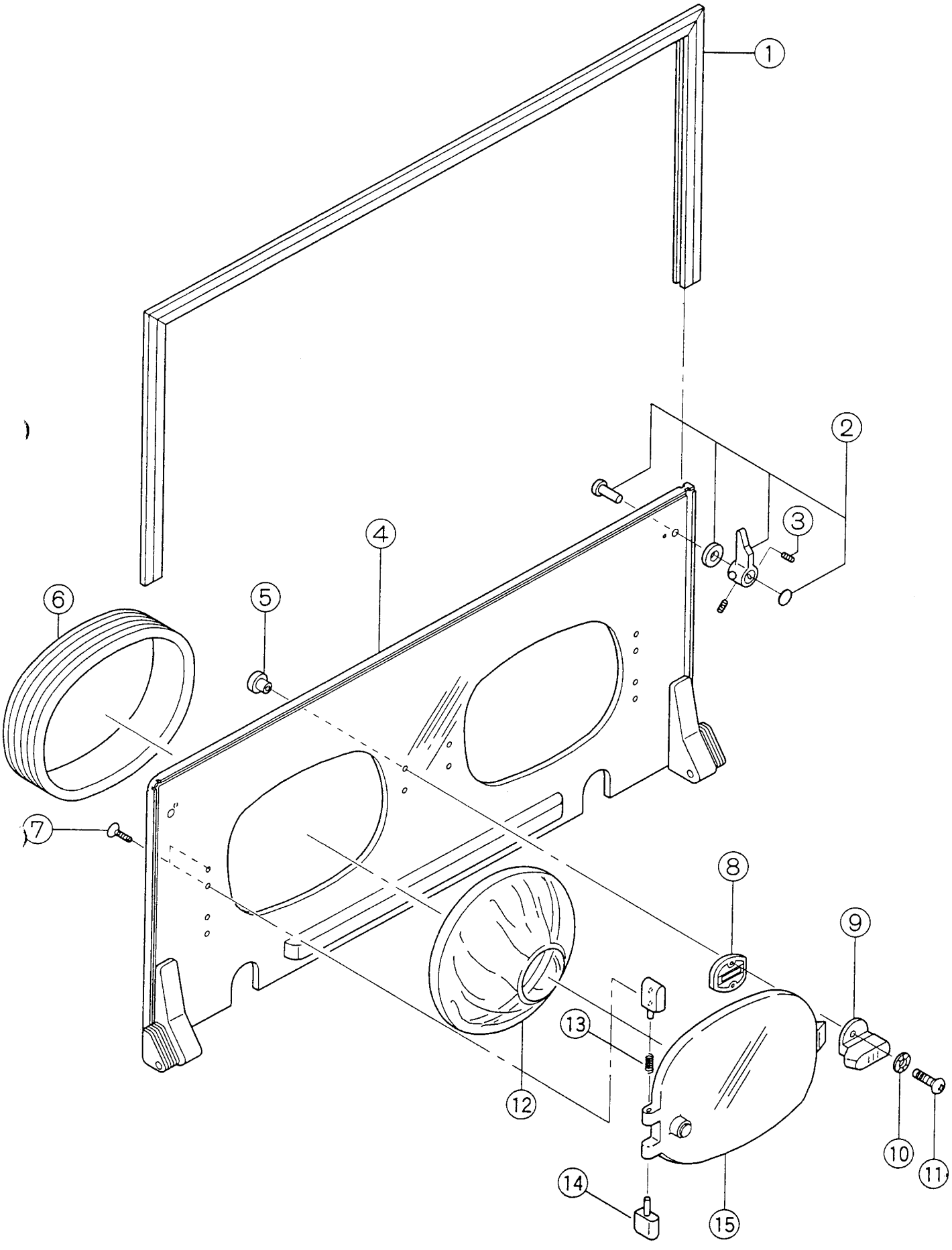


Fig.3 Front door assy

Fig.-No.	Part Name	Part No.
3 - 1	Front door rim seal	C231210
3 - 2	Front door lock knob (Right)	C23-016
	(Left)	C23-017
3 - 3	Hexagon socktet set screw, M4×6	V125101
3 - 4	Front door	C40-005
3 - 5	R flange nut	C231280
3 - 6	Snap-open access port rim seal	C231390
3 - 7	Truss head screw, M3×12	V013291
3 - 8	Elbow slider spacer	C231340
3 - 9	Elbow slider	C23-006
3 - 10	Toothed lock washer,M3	V053031
3 - 11	Truss head screw, M3×14	V013301
3 - 12	Semi-iris access port cover (10/set)	2301421
3 - 13	Twisted coil spring	C231310
3 - 14	Hinge axis holder	C231370
3 - 15	Snap-ope access port (Right)	C40-006
	(Left)	C23-007

Fig.4 Main deck assy

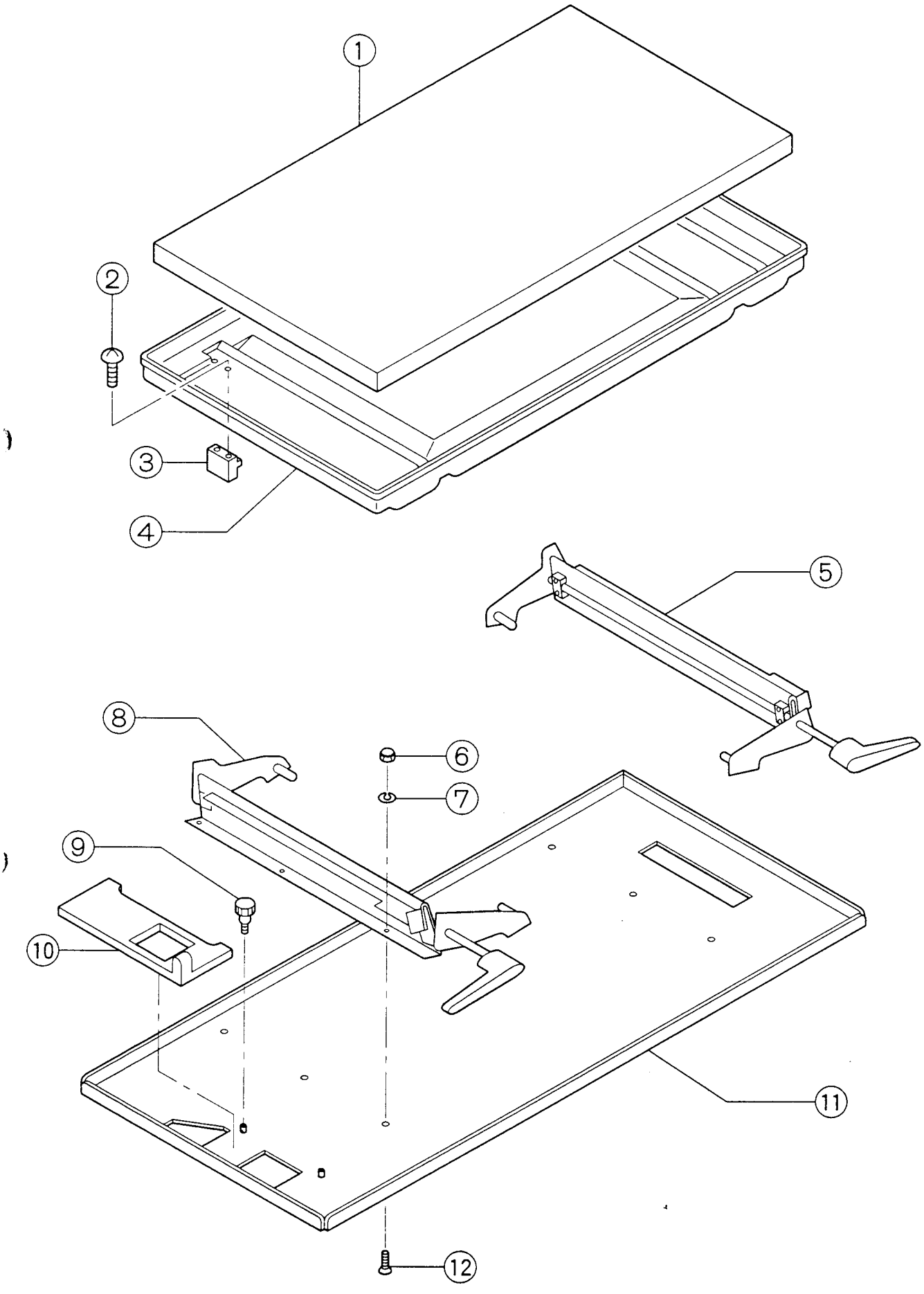


Fig.4 Main deck assy

Fig.-No.	Part Name	Part No.
4 - 1	Mattress	C012421
4 - 2	Phillips head tapping screw,M4×10 truss type1	V115390
4 - 3	Mattress platform stopper	C233271
4 - 4	Mattress platform	C23-021
4 - 5	Two-step platform tilting handle assy (Right)	C23-022
4 - 6	Cap nut,M4	V078022
4 - 7	Spring washer,M4	V044041
4 - 8	Two-step platform tilting handle assy (Left)	C23-023
4 - 9	Set screw for sliding plate	C012310
4 - 10	Humidification control sliding plate	C012320
4 - 11	Main deck	C40-007
4 - 12	Truss head screw,M4×10	V013441

Fig.5 Incubator base assy

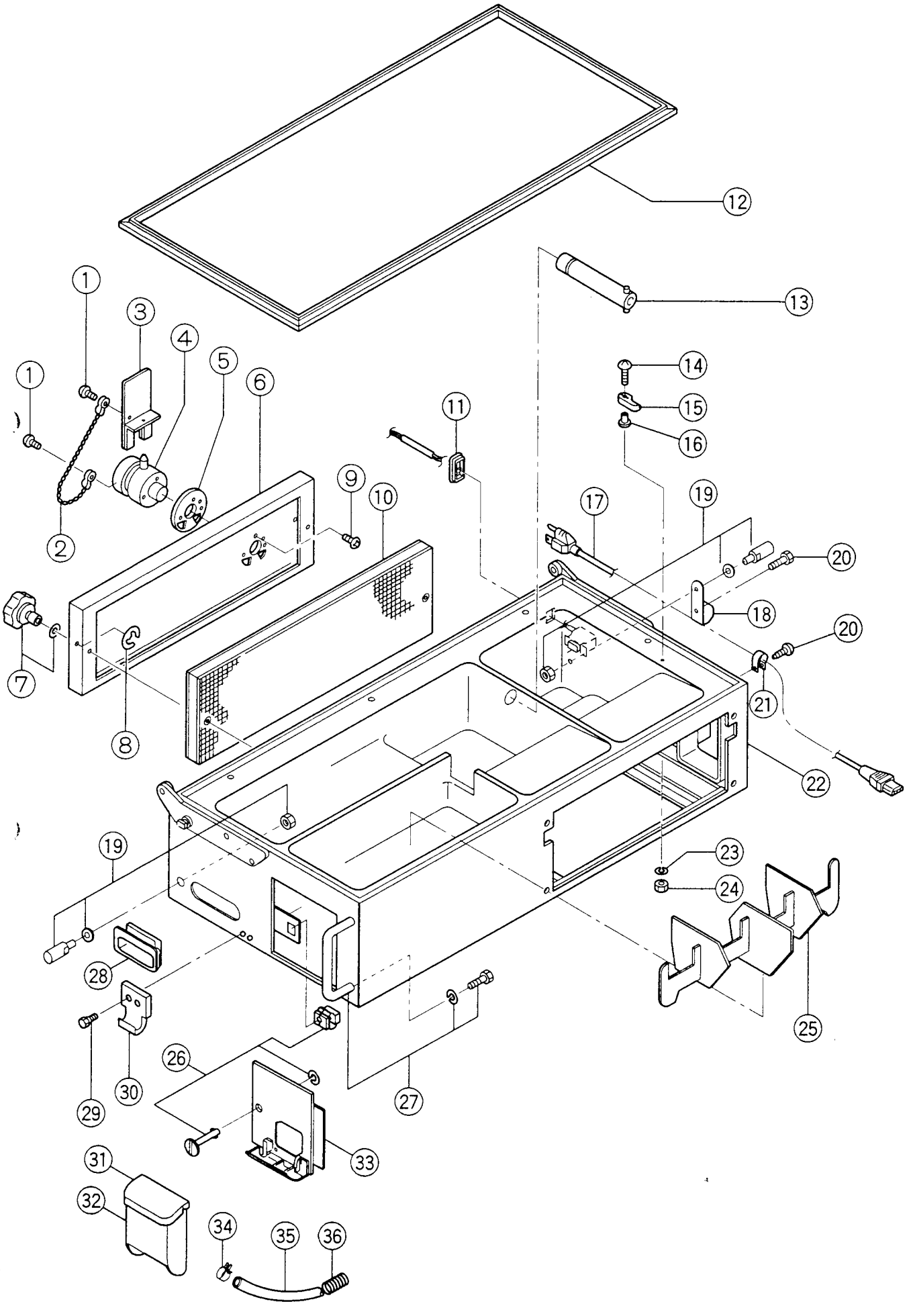


Fig.5 Incubator base assy

Fig.-No.	Part Name	Part No.
5 - 1	High oxygen administration indicating plate screw	C012170
5 - 2	Bead chain	C23-026
5 - 3	High oxygen administration indicating plate	C012163
5 - 4	Oxygen supply valve unit	C40-008
5 - 5	Oxygen supply valve packing	C012190
5 - 6	Filter cover	V23-028
5 - 7	Filter cover fixing knob	C40-009
5 - 8	E ring,E7	V091104
5 - 9	Pan-head screw (with spring washer), M4×10	V191131
5 - 10	F-4E high-functional electrate air filter (5/set)	2301580
5 - 11	Sensor cord bushing	C233060
5 - 12	Incubator base rim seal	C012440
5 - 13	Suction pipe	C40-010
5 - 14	Round head screw, M4×30	V011531
5 - 15	Main deck stopper	C233341
5 - 16	Stopper axis	C233350
5 - 17	Power cord	C23-032
5 - 18	Cord fuck	C402180
5 - 19	Fixed stud for PIT	C40-011
5 - 20	Phillips head tapping screw, M3×10 bind type 1	V113221
5 - 21	Nylon clip	P240060
5 - 22	Incubator base	C40-012
5 - 23	Spring washer, M4	V044041
5 - 24	Nut, M4	V071083
5 - 25	Humidity reservoir partition plate	C012410
5 - 26	Receptacle	C40-013
5 - 27	Guard handle	C40-014
5 - 28	Handle	Y061011
5 - 29	Pan-head screw (with spring washer), M3×8	V191021
5 - 30	Adjustable catch hook	V134504

Fig.-No.	Part Name	Part No.
5 - 31	Hiumidity reservoir cover	C402030
5 - 32	Hiumidity reservoir	C402020
5 - 33	Hiumidity reservoir door	C40-015
5 - 34	Hose retaining band	C012460
5 - 35	Humidity reservoir connection hose	C402150
5 - 36	Connection hose protecting	C012480

Fig.6 Power unit assy (Front)

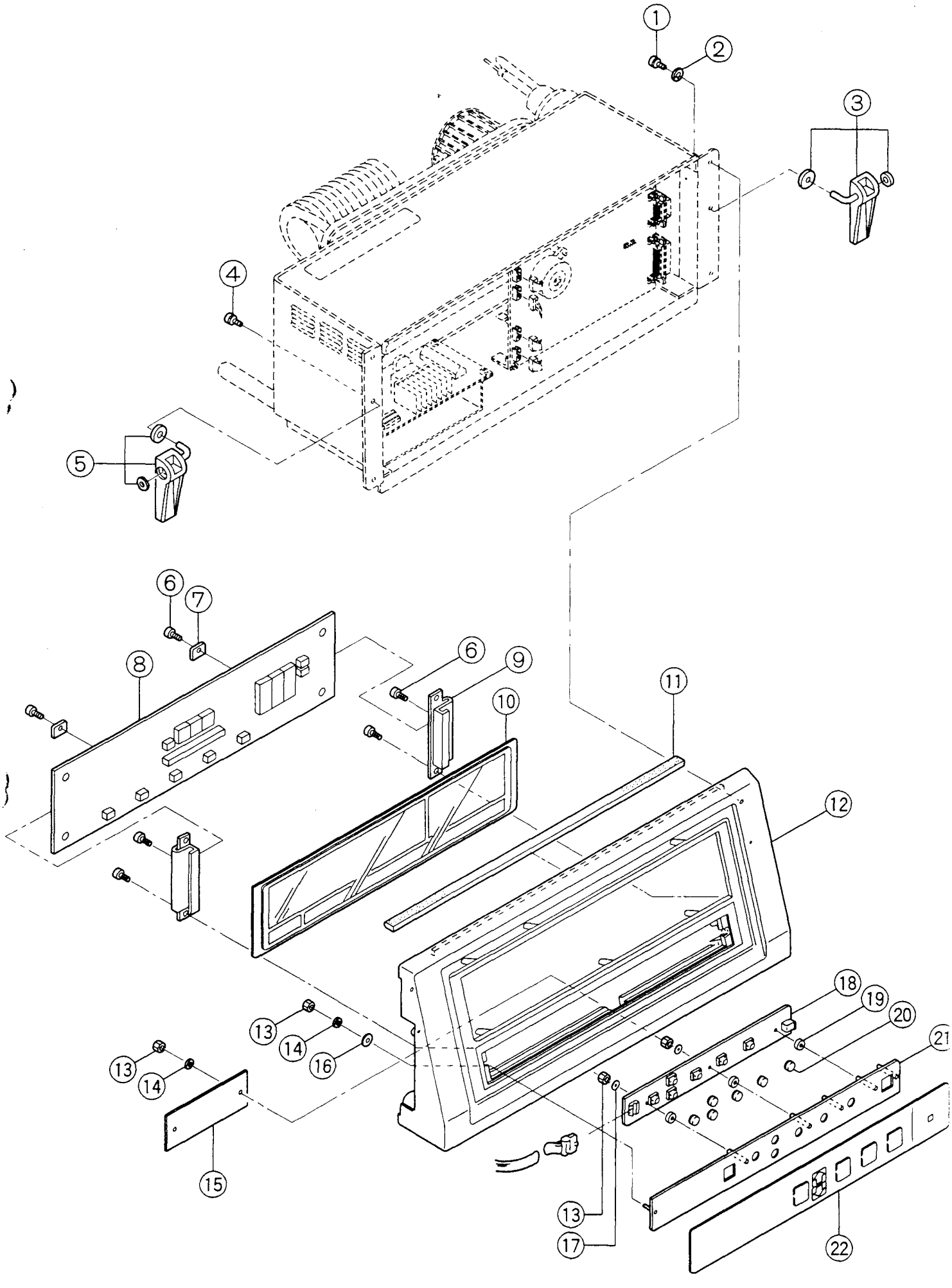


Fig.6 Power unit assy (Front)

Fig.-No.	Part Name	Part No.
6 - 1	Pan-head screw (with spring washer), M5×15	V191251
6 - 2	Washer φ5×φ15×4.2	X032025
6 - 3	Power unit fixing lever assy (Right)	C23-041
6 - 4	Pan-head screw (with spring washer), M5×10	V191231
6 - 5	Power unit fixing lever assy (Left)	C23-042
6 - 6	Pillips head tapping screw, M3×10 bind type 2	V114222
6 - 7	LED board fixing holder (S)	C403060
6 - 8	LED uit (SC)	C400710
	(MC)	C410710
6 - 9	LED board holder	C403040
6 - 10	Front panel (SC)	C403032
	(MC)	C423012
6 - 11	Power unit packing	C234100
6 - 12	Power panel	C234010
6 - 13	Nut, M3	V071063
6 - 14	Spring washer, M3	V044031
6 - 15	Setting plate	C234081
6 - 16	Flat washer, M3	V041044
6 - 17	Insulation washer, M3	V055014
6 - 18	Switch board assy (SC)	C230720
	(MC)	C410720
6 - 19	Spacer	C234110
6 - 20	Switch button	C234121
6 - 21	Switch board mounting plate	C234093
6 - 22	Front panel sheet (SC)	C409359
	(MC)	C429304

Fig.7 Power unit assy (Rear)

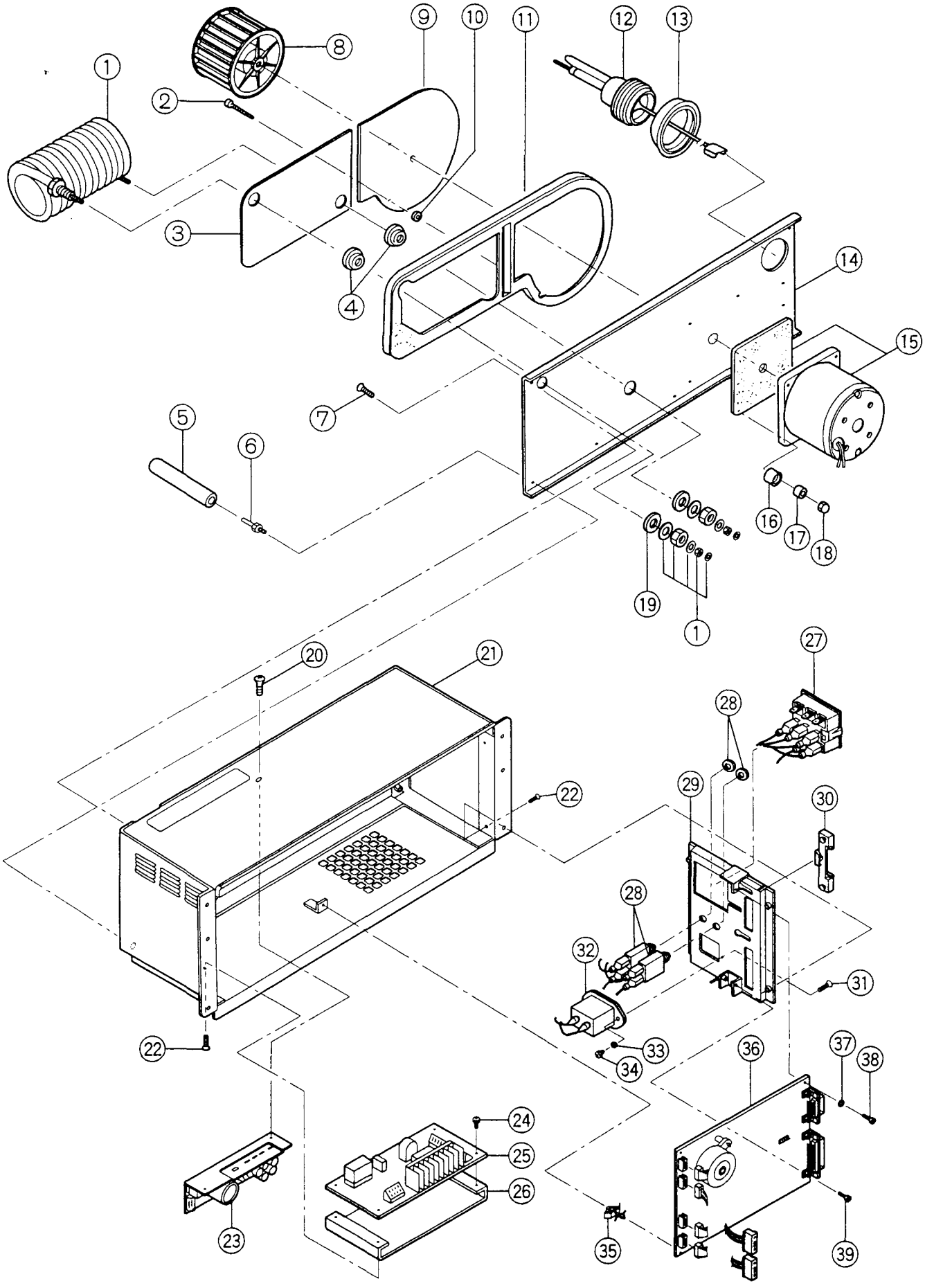


Fig.7 Power unit assy (Rear)

Fig.-No.	Part Name	Part No.
7 - 1	Heater (100V)	R023022
	(115V)	R023024
	(220V)	R023026
	(240V)	R023028
7 - 2	Round head screw, M4×30	V011531
7 - 3	Heater gasket setting plate	C013220
7 - 4	Heater insulation bushing	C013230
7 - 5	Power unit pull-out guide	C403050
7 - 6	Power unit set screw	C013390
7 - 7	Flat head screw, M5×8	V014581
7 - 8	Fan	T132001
7 - 9	Fan gaslet setting plate	C013250
7 - 10	Fangasket set screw	C013290
7 - 11	Power unit gasket	C013260
7 - 12	Sensor unit	C230430
7 - 13	Sensor unit gasket	C013330
7 - 14	Power unit rear plate	C013211
7 - 15	Fan motor (100-120V)	C23-037
	(220-240V)	C23-038
7 - 16	Motor anti-vibration rubber	C013300
7 - 17	Motor tightening collar	X032022
7 - 18	Cap nut, M4	V072082
7 - 19	Heater insulation washer	C013240
7 - 20	Flat head screw, M3×6	V014251
7 - 21	Power unit base	C23-039
7 - 22	Flat head screw, M3×8	V014271
7 - 23	Switching regulator	N182002
7 - 24	Pan-head screw (with spring washer), M3×6	V191011
7 - 25	Heater board assy (100-120V)	C230880
	(220-240V)	C230890

Fig.-No.	Part Name	Part No.
7 - 26	Heater bord mounting plate	C234242
7 - 27	Power switch	P015004
7 - 28	Circuit breaker 4A (100-120V)	P020005
	2A (220-240V)	P020003
7 - 29	Power unit side cover	C23-040
7 - 30	Sensor connctor lock	C234150
7 - 31	Flat head screw, M3×10	V014281
7 - 32	Noise filter	N200002
7 - 33	Spring washer, M3	V044031
7 - 34	Nut, M3	V071063
7 - 35	Double locking spacer	P220006
7 - 36	CPU bord assy	C230710
7 - 37	Insulation washer, M3	V055014
7 - 38	Round head screw, M3×18	V011271
7 - 39	Pan-head screw (with spring washer), M3×10	V191031

Fig.8 Cabinet assy

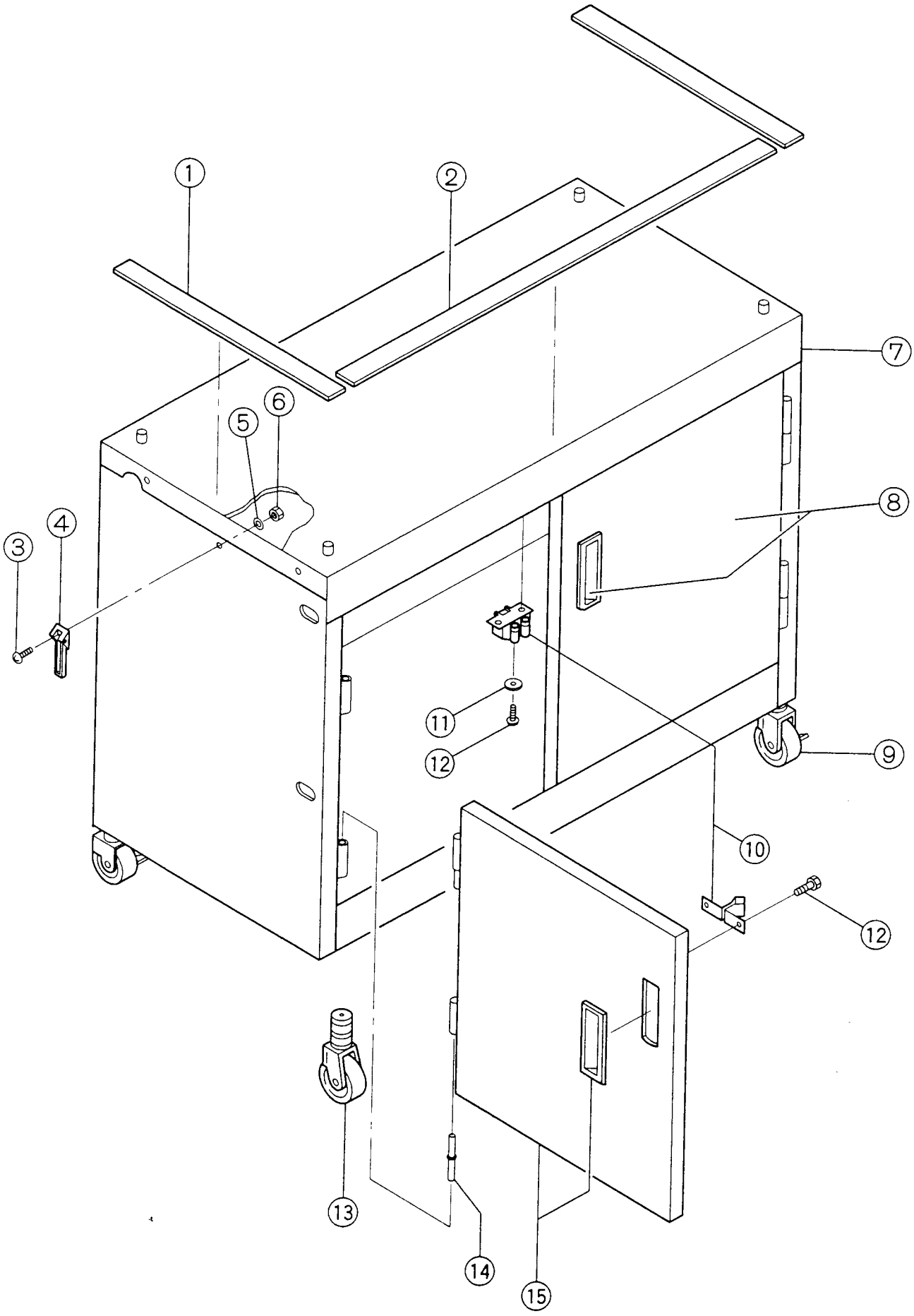


Fig.8 Cabinet assy

Fig.-No.	Part Name	Part No.
8 - 1	Body holding rubber (Short)	C014050
8 - 2	Body holding rubber (Long)	C014040
8 - 3	Rouund head screw, M3×8	V011271
8 - 4	Adjustable catch	V134004
8 - 5	Spring washer, M3	V044031
8 - 6	Nut, M3	V071063
8 - 7	Cabinet body	C23-043
8 - 8	Cabinet open/close door (Right)	C23-044
8 - 9	Caster (with stopper)	Y054042
8 - 10	Roller catch	Y138008
8 - 11	Flat washer, M3	V041044
8 - 12	Pillips head tapping screw, M3×10 bind type 2	V114222
8 - 13	Caster	Y054041
8 - 14	Hinge axis	C235040
8 - 15	Cabinet open/close door (Left)	C23-045

Fig.9 Consumables/Accessories

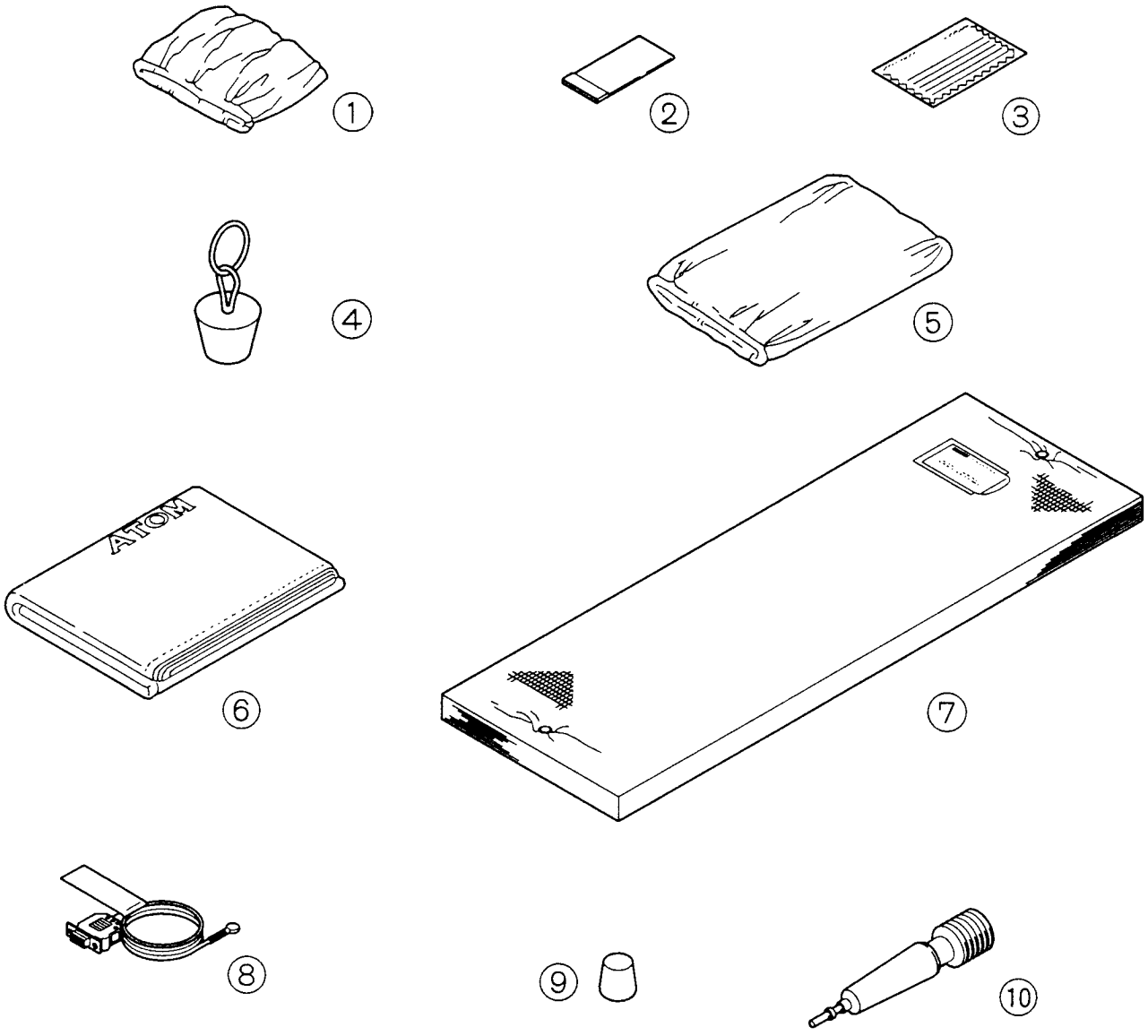


Fig.-No.	Part Name	Part No.
9 - 1	Semi-iris access port cover (10/set)	2301421
9 - 2	Humidity sensor wetty (100/set)	2302581
9 - 3	I.D. card (50/set)	C23-009
9 - 4	Air leak stopper	C40-016
9 - 5	Access port cover (10/set)	2300161
9 - 6	Dust cover	C016020
9 - 7	F-4E high-functional electrate air filter (5/set)	2301580
9 - 8	Temperature probe (SC)	C230860
9 - 9	Rubber cap	C016010
9 - 10	Syringe	C126110

7.1995. Printed in Japan

ATOM®

ATOM MEDICAL CORPORATION
3-18-15, Hongo, Bunkyo-ku, Tokyo, Japan.
Cable: ATOMMEDICAL TOKYO
Telex: 02722873 ATOM J
Phone: (03)3815-2311
Fax: (03)3812-3144